

C 4000
Safety Light Curtain

SICK



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1 About this document

Please read this chapter carefully before working with this documentation and the C 4000.

1.1 Function of this document

These operating instructions are designed to address the *technical personnel of the machine manufacturer or the machine operator* in regards to safe mounting, installation, configuration, electrical installation, commissioning, operation and maintenance of the Safety Light Curtain C 4000.

These operating instructions do *not* provide instructions for operating machines on which the safety light curtain is, or will be, integrated. Information on these items is found in the appropriate operating instructions of the machine.

1.2 Target group

These operating instructions are addressed to *planning engineers, developers* and the *operators* of plants and systems which are to be safeguarded by one or several safety light curtains C 4000. It also addresses persons who integrate the C 4000 into a machine, initialise its use, or who are in charge of servicing and maintaining the unit.

1.3 Information depth

These operating instructions contain information on:

- Installation and mounting
- Electrical installation
- Commissioning and configuration
- Care and maintenance
- Fault and error diagnosis and trouble-shooting
- Part numbers
- Conformity and approval

of the safety light curtain C 4000.

Planning and using safety devices such as the C 4000 also require specific technical skills which are not detailed in this documentation.

When operating the C 4000, the national, local and statutory rules and regulations must be observed.

General information on health and safety at work and accident prevention using opto-electronic safety devices can be found in the brochure "Safe machinery with opto-electronic protection".

Note We also refer you to the C 4000 homepage on the Internet at
www.c4000.com

Here you will find information on:

- Sample applications
- A list of frequently asked questions about the C 4000
- These operating instructions in different languages for viewing and printing

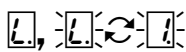
1.4 Abbreviations

ESPE	Electro-sensitive protective equipment (e.g. C 4000)
CDS	SICK Configuration & Diagnostic Software = software for the configuration of your safety light curtain C 4000
EDM	External device monitoring
OSSD	Output signal switching device

1.5 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Refer to notes for special features of the device.



Display indicators show the status of the 7-segment display of sender or receiver:



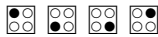
Constant display of the letter F



Flashing display of the letter F



Alternating display of F and 2



LED symbols denote a flashing LED (upright orientation, 7-segment display, bottom)

➤ Take action ...

Instructions for taking action are shown by an arrow. Read carefully and follow the instructions for action.



WARNING

Warning notice!

A warning notice indicates an actual or potential risk or health hazard. They are designed to help you to prevent accidents.



Read carefully and follow the warning notices!



Software notes show the location in the CDS (Configuration & Diagnosis Software) where you can make the appropriate settings and adjustments. Go to the menu **View, Dialogue windows** of the CDS and activate the item **File cards** to view the named dialogue fields as needed. Alternatively, the Software Assistant will guide you through the appropriate setting.



Sender and receiver

In drawings and diagrams, the symbol  denotes the sender and the symbol  denotes the receiver.

The term “dangerous state”

The dangerous state (standard term) of the machine is always shown in the drawings and diagrams of this document as the movement of a machine part. In practical operation, there may be a number of different dangerous states:

- Machine movements
- Electrical conductors
- Visible or invisible radiation
- A combination of several risks and hazards

2 On safety

This chapter deals with your own safety and the safety of the equipment operators.

➤ Please read this chapter carefully before working with the C 4000 or with the machine protected by the C 4000.

2.1 Specialist personnel

The safety light curtain C 4000 must be installed, commissioned and serviced only by specialist personnel. Specialist personnel are defined as persons who

- have undergone the appropriate technical training

and

- who have been instructed by the responsible machine operator in the operation of the machine and the current valid safety guidelines

and

- who have access to these operating instructions

2.2 Applications of the device

The safety light curtain C 4000 is an electro-sensitive protective equipment (ESPE). The physical resolution is 14, 20, 30 or 40 mm with a maximum protective field width of 19 metres (resolution 20 mm and higher). The realisable protective field height is between 300 and 1,800 mm.

The device is a *Type 4 ESPE* as defined by IEC 61496-1 and -2 and is therefore allowed for use with controls in safety category 4 in compliance with EN 954. The device is suitable for

- Hazardous point protection (finger and hand protection)
- Hazardous area protection
- Access protection

Access to the hazardous point must be allowed only through the protective field. The plant/system is not allowed to start as long as personnel are within the hazardous area. Refer to section 3.3 “Examples of range of use” on page 12 for an illustration of the protection modes.

Depending on the application, mechanical protection devices may be required in addition to the safety light curtain.

Note The safety light curtain C 4000 operates as a standalone system, comprising a sender and receiver, or in combination with other cascable C 4000 systems. This means that the protective field can be adapted to suit individual safety requirements.

2.3 Correct use

The safety light curtain C 4000 must be used only as defined in the section 2.2 “Applications of the device”. It must be used only by qualified personnel and only on the machine where it has been installed and initialised by qualified personnel.

If the device is used for any other purposes or modified in any way—also during mounting and installation—any warranty claim against SICK AG shall become void.

2.4 General protective notes and protective measures

**WARNING**

Safety notes

Please observe the following procedures in order to ensure the correct and safe use of the safety light curtain C 4000.

- The national/international rules and regulations apply to the installation, use and periodic technical inspections of the safety light curtain, in particular:

- Machine Directive 98/37/EEC
- Equipment Usage Directive 89/655/EEC
- the work safety regulations/safety rules
- other relevant health and safety regulations

Manufacturers and users of the machine with which the safety light curtain is used are responsible for obtaining and observing all applicable safety regulations and rules.

- The notices, in particular the test regulations (see “Test notes” on page 37) of these operating instructions (e.g. on use, mounting, installation or integration into the existing machine controller) must be observed.
- The tests must be carried out by specialist personnel or specially qualified and authorised personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- The operating instructions must be made available to the user of the machine where the safety light curtain C 4000 is fitted. The machine operator is to be instructed in the use of the device by specialist personnel and must be instructed to read the operating instructions.
- The external voltage supply of the device must be capable of buffering brief mains voltage failures of 20 ms as specified in EN 60 204. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).

2.5 Protection of the environment

The safety light curtain C 4000 has been designed to minimise environmental impact. It uses only a minimum of power and natural resources.

At work, always act in an environmentally responsible manner. For this reason please note the following information on disposal.

Disposal

- Always dispose of unserviceable or irreparable units in compliance with local/national rules and regulations with respect to waste disposal.

Note We would be pleased to be of assistance on the disposal of this device. Contact your local SICK company or agent.

3 Product description

This chapter provides information on the special features and properties of the safety light curtain C 4000. It describes the structure and the mode of function of the unit, in particular the different operating modes.

➤ Please read this chapter before mounting, installing and commissioning the unit.

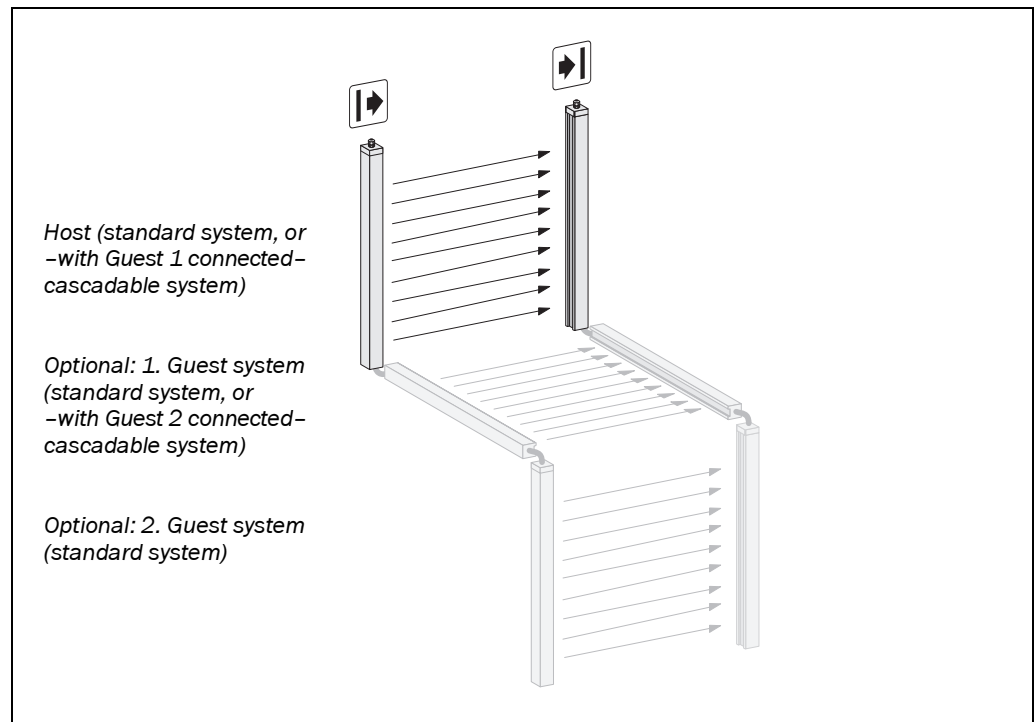
3.1 Special features

- Protective operation, optionally with internal or external machine-integrated restart interlock
- Connecting options for the reset button
- External device monitoring (EDM)
- Beam coding
- Status display with 7-segment display
- Optional: Function package B
 - Blanking several areas
 - Blanking with tolerance of up to 2 beams
 - Floating blanking
 - Reduced resolution
 - Monitoring of the blanked area

3.2 Mode of function of the device

3.2.1 Components of the device

Fig. 1: Components of the C 4000



Please refer to chapter 10 “Technical specifications” on page 44 for the data sheet.
Please refer to pages 50ff. for the dimensional drawings.

3.2.2 The light curtain principle

The safety light curtain C 4000 consists of a sender and a receiver (Fig. 1). Between these two units is the protective field, defined as the protective field height and the protective field width.

The construction size height determines the *height of the protective field* of the appropriate system. The upper and lower limit of the protective field is shown by markings on the profile sections.

The *width of the protective field* is derived from the length of the light path between sender and receiver and must not exceed the maximum rated width of the protective field (see “Technical specifications” on page 44).

Sender and receiver automatically synchronise themselves optically. An electrical connection between both components is not required.

The C 4000 is modular in structure. All optical and electronic components and assemblies are housed in a slim and torsionally rigid housing.

3.2.3 Cascading

To provide an effective point-of-operation guard, a maximum of three C 4000 can be connected in series for cascading configuration. The device connected to the control cabinet is the main sensor, called *Host*. The subsequent sensors are called *Guest* (cf. Fig. 1 on page 10).

Benefits of cascading

- No additional external circuitry required
- Resolution and protective field height may differ among the individual systems

Limits of cascading

- The maximum protective field width must be guaranteed for each individual system!
- The maximum total number of beams must not exceed 480 beams in non-coded operation, and a maximum of 405 beams in coded operation.
- The maximum cable length between two cascaded systems must not exceed 3 metres.

3.3 Examples of range of use

Fig. 2: Safeguarding hazardous points with a safety light curtain C 4000 (left)

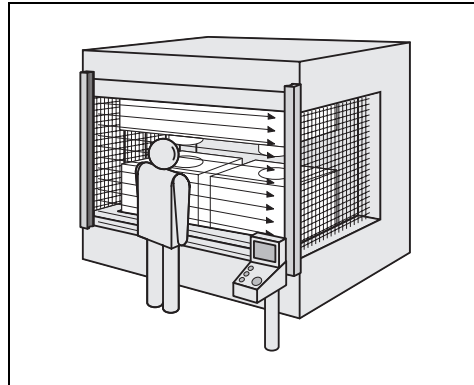


Fig. 3: Safeguarding hazardous areas with a safety light curtain C 4000 (right)

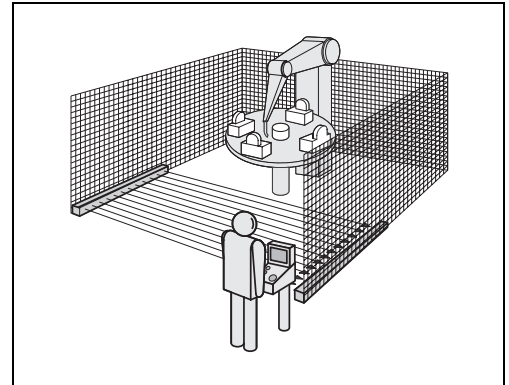
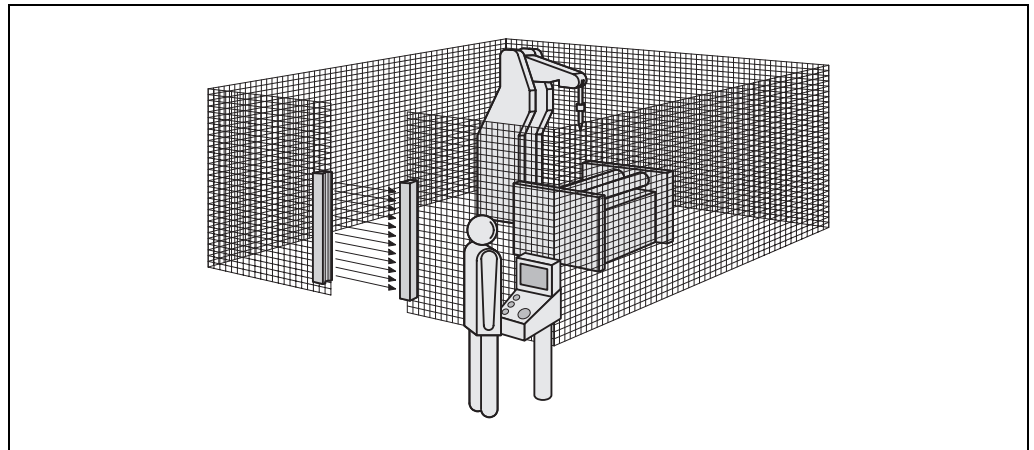


Fig. 4: Access guarding using a safety light curtain C 4000



The safety light curtain C 4000 operates correctly as a protective device only if the following conditions are met:

- The control of the machine must be electrical.
- The dangerous state of the machine must be transferable at any time into a safe state.
- Sender and receiver unit must be so mounted that objects penetrating the hazardous area are safely identified by the C 4000.
- The restart button must be fitted outside the hazardous area such that it cannot be operated by a person working inside the hazardous area.
- The statutory and local rules and regulations must be observed when installing and using the device.

3.4 Configurable functions

This section describes the functions of the safety light curtain C 4000 which are selectable via software. Some of the functions can be combined.



WARNING

Test the protective device after any changes!

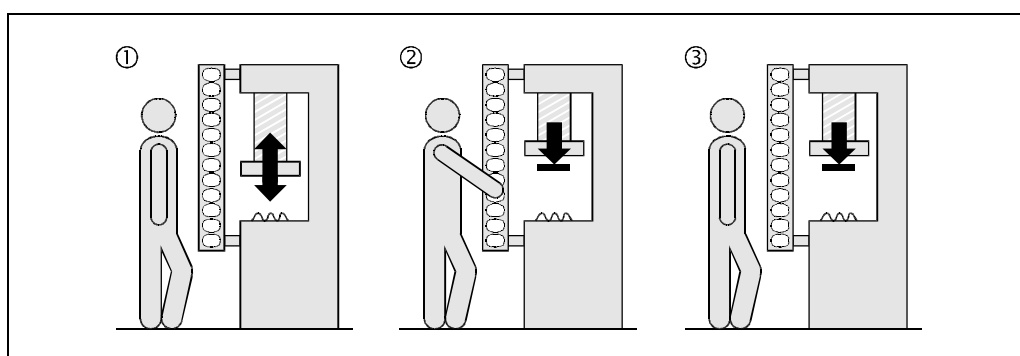
The entire protective device must be tested for correct operation after each change of the configuration (see 6.3 on page 37).



When starting to configure the device, you may save an application name with a maximum of 22 characters. Use this function as a “memory jog”, e.g. to describe the application of the current device configuration.

3.4.1 Restart interlock

Fig. 5: Outline drawing of the protective operation



The dangerous state of the machine (①) is stopped if the light curtain (②) is infringed and will not be restarted (③) until the user actuates the restart button.

The restart interlock can be implemented in two different ways:

- With the internal restart interlock of the C 4000:
The C 4000 controls the restart.
- With the restart interlock of the machine:
The C 4000 has no control over the restart.

The possible combinations are shown in the following table:

Tab. 1: Permissible configuration of the restart interlock

Restart interlock of the C 4000	Restart interlock of the machine	Permissible application
deactivated	deactivated	Only if one cannot stand between the light curtain and the machine. Observe EN 60 204-1!
deactivated	activated	All
activated	deactivated	Only if one cannot stand between the light curtain and the machine. Observe EN 60 204-1!
activated	activated	All. Restart interlock of the C 4000 handles the reset function (see below).



WARNING

Always configure the C 4000 with restart interlock!

The C 4000 is unable to verify if the restart interlock of the machine is operable. If you deactivate both the C 4000 and the machine-internal restart interlock, the users and operators of the machine will be at an acute risk of injury.

The electrical connection of the restart button is described in the section “Reset button/restart button” on page 35.



Device symbol **C 4000 receiver**, context menu **Configuration draft**, **Edit**, file card **General**, option **Restart interlock**.

Reset

If you activate both the C 4000 and the machine-internal restart interlock, each restart interlock will have its own button designated to it.

When actuating the button for the internal restart interlock

- the C 4000 will reset its switched outputs
- the indicators change from red to green

The machine-internal restart interlock prevents the machine from restarting. This is why the button of the internal restart interlock only fulfills the reset function in this configuration and is called Reset Button.

After activating the reset button, the user must also press the restart button. If the reset button and the restart button are not pressed in this specified sequence, the dangerous status remains unchanged.

Recommendation

The reset button prevents the accidental and inadvertent operation of the restart button. The user must first acknowledge the dangerous state with the reset button.

The electrical connection of the reset button is described in section “Reset button/restart button” on page 35.

3.4.2 External device monitoring (EDM)

The EDM function monitors the contact elements (if used) activated by both of the device outputs (e.g. external contacts). The machine must be allowed to restart only if both contactors have been opened.

The C 4000 monitors the contactors after every interruption of the light path and before the machine restart. The EDM can so identify if one of the contactors has fused, for instance. In this case

- the error message appears (in the 7-segment display)
- the safety light curtain changes to red
- with the internal restart interlock activated, the safety light curtain signals by flashing yellow LED “Reset required”

Note

If the system is unable to change to a safe operational state (e.g. after contactor failure), the system interlocks and shuts down completely (“Lock-out”). The 7-segment display will then show the error message .

The electrical connection of the EDM is described in section “External Device Monitoring (EDM)” on page 34.



Device symbol **C 4000 receiver**, context menu **Configuration draft**, **Edit**, file card **General**, option **EDM**.

3.4.3 Beam coding

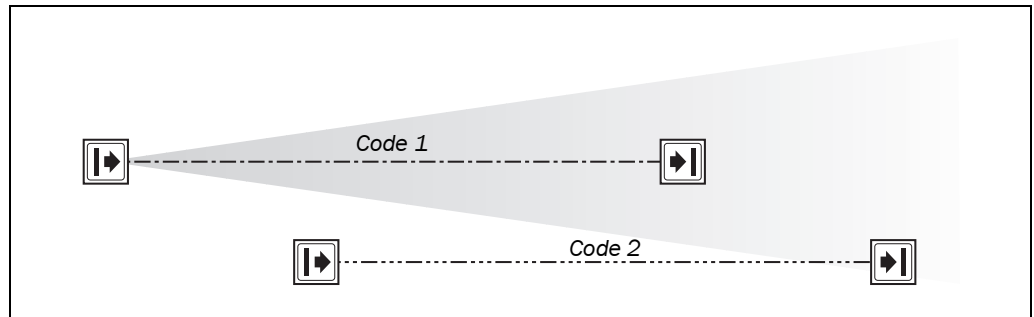
If several safety light curtains operate in close proximity to each other, the sender beams of one system may interfere with the receiver of another system. With code 1 or 2 activated, the receiver can distinguish the beams designated for it from other beams. The following settings are available: non-coded, code 1 and code 2.



Use different beam codings if the systems are mounted in close proximity!

Systems mounted in close proximity to each other must be operated with different beam codings (non-coded, code 1 or code 2). If this precaution is neglected, the system may be impaired in its protective function by the beams from the neighbouring system and so change to the unsafe state. This would mean that the user/operator is at risk.

Fig. 6: Schematic layout of the beam coding



Notes

- Beam coding increases the availability of the protected machine. Beam coding also enhances the resistance to optical interference such as weld sparks or similar.
- In a cascaded system, host and guest can be operated only with the same beam coding.
- Beam coding will increase the response time of the system. This will also change the required safety distance. For details refer to section 4.1 “Determining the safety distance” on page 22.
- After activating the system, sender and receiver will briefly display the coding.
- If operated with beam coding, the number of beams in cascaded systems must not exceed 405.



Device symbol **C 4000 receiver** or **sender**, context menu **Configuration draft, Edit**, file card **General**, option **Beam coding**.

3.4.4 Scanning range



Match the scanning range with the protective field width!

The scanning range of the system (host, guest 1 and guest 2) must be adapted to the width of the protective field.

- If the scanning range is set too low, the light curtain may not switch to green.
- If the scanning range is too great, the light curtain may malfunction. This would mean that the user/operator is at risk.

Note

If you are using the additional front screen (see page 64) available as an accessory, the useful scanning range will be reduced by 8% for each additional front screen.

The available settings depend on the physical resolution of the system:

Tab. 2: Physical resolution and scanning range

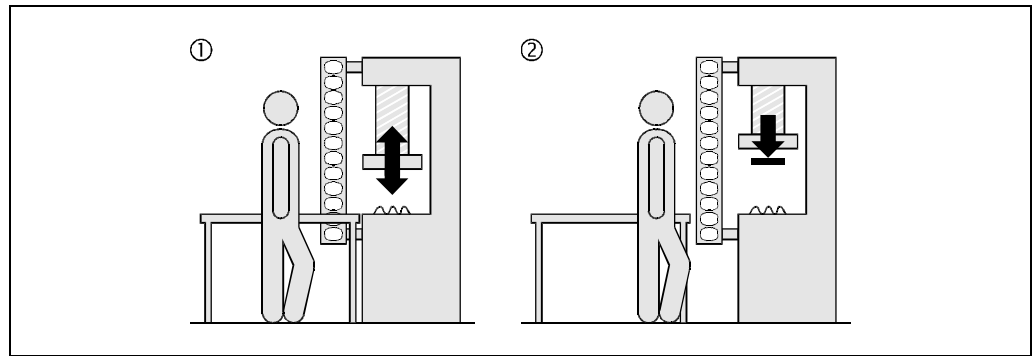
Physical resolution	Selectable scanning ranges	Scanning range with 1 additional front screen	Scanning range with 2 additional front screens
14 mm	0–2.5 m 2–6 m	0–2.3 m 1.8–5.5 m	0–2.1 m 1.7–5 m
20 mm, 30 mm, 40 mm	0–6 m 2.5–19 m	0–5.5 m 2.3–17.4 m	0–5 m 2.1–16 m



Device symbol **C 4000 receiver** or **sender**, context menu **Configuration draft, Edit, Step 5**, option **Scanning range**.

Fig. 7: Schematic layout of the fixed blanking

3.4.5 Fixed blanking



The light curtain C 4000 is capable of fixed-blanking one or several adjacent beams, e.g. to allow continued operation in spite of an obstruction such as a table placed permanently in the light path.

The blanked area will no longer be part of the protective field. Objects to be blanked out must therefore be permanently located inside the blanked area (①). As soon as the object is removed from the beam path, the light curtain will send a signal to stop the dangerous movement (②). Protection is otherwise no longer guaranteed.



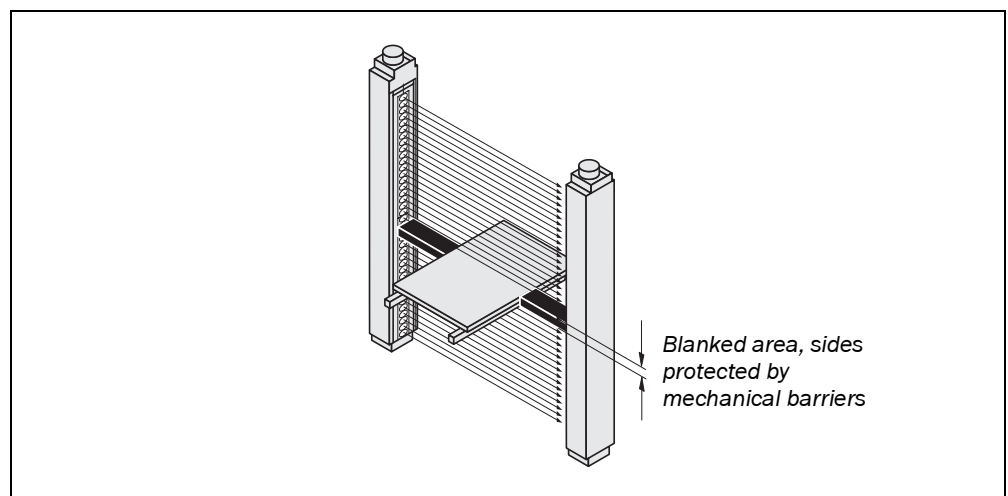
WARNING

Completely protect the blanked area!

The object must cover the entire distance between sender and receiver.

- If necessary, protect the areas to the left and right of the object against intrusion by fitting mechanical barriers!

Fig. 8: Protecting a fixed blanking using mechanical barriers




- Also, make sure that the object can only be removed as a whole together with the barriers.
- After modifying the blanking, check the protective field with the test rod. Instructions can be found in section 6.3.3 on page 38.

Properties of fixed blanking

- The C 4000 is capable of blanking a total of four areas simultaneously. A minimum of one beam spacing must exist between two blanked areas.
- The first beam of the light curtain (close to the 7-segment display) cannot be blanked. It is needed for the synchronisation between sender and receiver.
- For objects subject to vibration, you can select a positional tolerance of the area with a maximum of ± 2 beams.
- In addition, you can define a size tolerance of -1 beam.

Notes

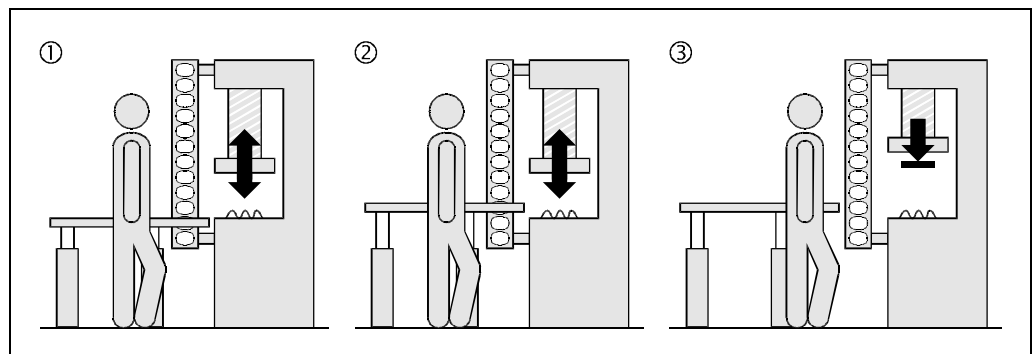
- If you configure a blanked area *without* positional and *without* size tolerance, the movement of the object within the area is very limited before the light curtain may change to red.
- The maximum selectable tolerance values depend on the size of the blanked area: The actual tolerance expansion in millimetres differs. It depends on the physical resolution of the device.
- With fixed blanking, the 7-segment display indicates  as soon as sender and receiver are aligned.



Device symbol **C 4000 receiver**, context menu **Configuration draft, Edit**, file card **Blanking** of the appropriate system, **Type of blanking** = fixed. With the help of selection fields, the size of the area and the tolerance values (in millimetres) for size and position can be selected.

3.4.6 Floating blanking

Fig. 9: Schematic layout of the floating blanking



The light curtain C 4000 is capable of blanking an area of two or more adjacent beams (①). In contrast to fixed blanking, the blanked area is allowed to move (②) without the light curtain changing to red.

The blanked area will no longer be part of the protective field. Moving objects must therefore be permanently within the protective field (① and ②). As soon as the object is removed from the protective field, the light curtain will send a signal to stop the dangerous movement (③). Protection is otherwise no longer guaranteed.

Properties of floating blanking

- The C 4000 is capable of blanking a total of four areas simultaneously.
- Fixed and floating blanking can be mixed.
- The size of the movable area must be at least equal to the effective resolution (see page 19 if you use reduced resolution).
- Areas of floating blanking must not be allowed to make contact or overlap during operation. The CDS (Configuration & Diagnostic Software) will check this automatically.
- The first beam of the light curtain (close to the 7-segment display) cannot be blanked. It is needed for the synchronisation between sender and receiver.

- Size tolerances of 1 or 2 beams may be selected for moving areas. In case of 2 beams (increased size tolerance), the effective resolution at the edges of the moving area will be reduced! For this reason the moving area must always be greater than the effective resolution at the edges of the area (see Tab. 3).
- The size tolerance of 2 beams can be used only in devices with a physical resolution of 14 mm and 20 mm.

Tab. 3: Effective resolution in floating blanking with size tolerance

Physical resolution	Size tolerance	Effective resolution at the edges of the area with floating blanking
14 mm	1 beam	14 mm
	2 beams	22 mm
20 mm	1 beam	20 mm
	2 beams	30 mm
30 mm	1 beam	30 mm
	2 beams	Not possible
40 mm	1 beam	40 mm
	2 beams	Not possible



WARNING

Check the safety distance!

In case of floating blanking *and* increased size tolerance (2 beams), the required safety distance will depend on the *effective* resolution.

➤ If required, recalculate the safety distance and readjust it on the machine.

Example: – Physical resolution 14 mm
 – Increased size tolerance (2 beams)
 – Effective resolution 22 mm

Calculate the safety distance with a resolution of 22 mm.

➤ Mark the effective resolution on the information label of sender and receiver.

Fig. 10: Marking the effective resolution on the device label


- Attention: In operation with „floating blanking“ and „increased size tolerance“, the safety distance in accordance with the changed resolution must be maintained.

Resolution changed to:
(please mark)

		physical resolution	
		14 mm	20 mm
Increased size tolerance	2 beams	effective resolution	
		22 mm	<input checked="" type="checkbox"/> 30 mm

4 024 160

Note

With floating blanking, the 7-segment display indicates  as soon as sender and receiver are aligned.

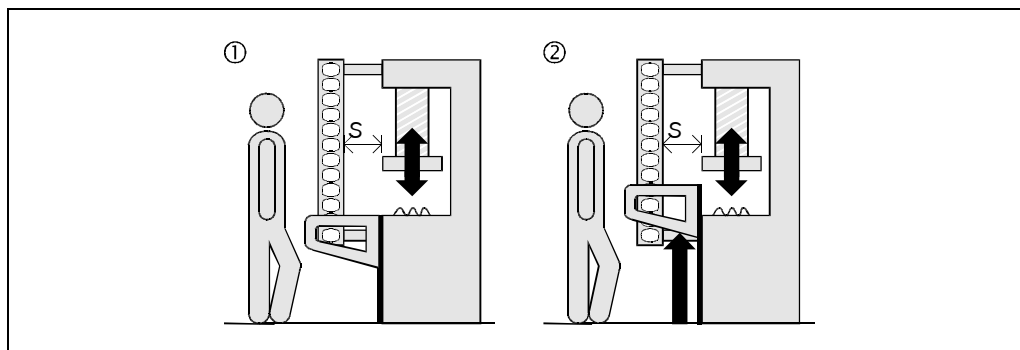


Device symbol **C 4000 receiver**, context menu **Configuration draft, Edit**, file card **Blanking** of the appropriate system **Type of blanking** = floating. With the help of the selection fields, the size of the area can be selected (in millimetres).

3.4.7 Reduced resolution

Under reduced resolution, the light curtain ignores the interruption of 1, 2 or 3 adjacent beams. Objects which are not larger then specified in Tab. 4 may be moved through the light curtain without the light curtain changing to red (Fig. 11, ① and ②).


Fig. 11: Schematic outline of the operation with reduced resolution (example: reduction by one beam)



Tab. 4: Effective resolution and maximum size of moving objects under reduced resolution

Physical resolution	Reduction	Effective resolution	Maximum size of movable objects
14 mm	1 beam	22 mm	10 mm
	2 beams	30 mm	18 mm
	3 beams	37 mm	25 mm
20 mm	1 beam	30 mm	14 mm
	2 beams	40 mm	24 mm
	3 beams	Not possible	—

Notes

- The function Reduced Resolution can be used only in devices with a physical resolution (original default value) of 14 mm and 20 mm.
- The first beam of the light curtain (close to the 7-segment display) must not be interrupted. Otherwise, the safety light curtain will change to red.
- The system response time does not change under reduced resolution.
- With reduced resolution, the 7-segment display indicates  as soon as sender and receiver are aligned.



WARNING

Check the safety distance!

The safety distance required under reduced resolution depends on the *effective* resolution.

➤ If required, recalculate the safety distance and readjust it on the machine.

Example: – Physical resolution 14 mm
 – Resolution reduced by 1 beam
 – Effective resolution 22 mm

Calculate the safety distance with a resolution of 22 mm.

➤ Mark the effective resolution on the information label of sender and receiver.

Fig. 12: Marking the effective resolution on the device label

• Attention: If operating with "reduced resolution" the safety distances must be in accordance with the modified resolution.

	physical resolution		
	14 mm	20 mm	
reduction			effective resolution
1 beam	22 mm	<input checked="" type="checkbox"/>	30 mm
2 beams	30 mm		40 mm
3 beams	37 mm		no possible

Resolution changed to:
(please mark)

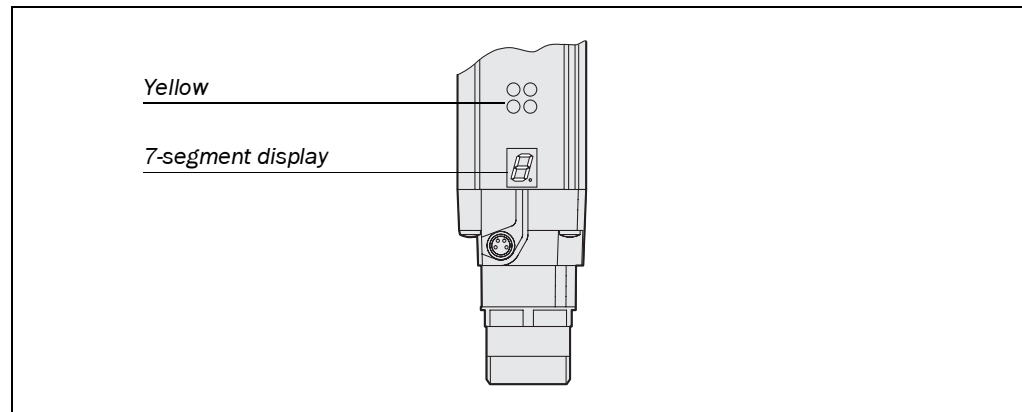
4 034 160

3.5 Indicator elements

The LEDs and the 7-segment display of sender and receiver signal the operating status of the C 4000.

3.5.1 Status indicators of the sender

Fig. 13: Status indicators of the sender



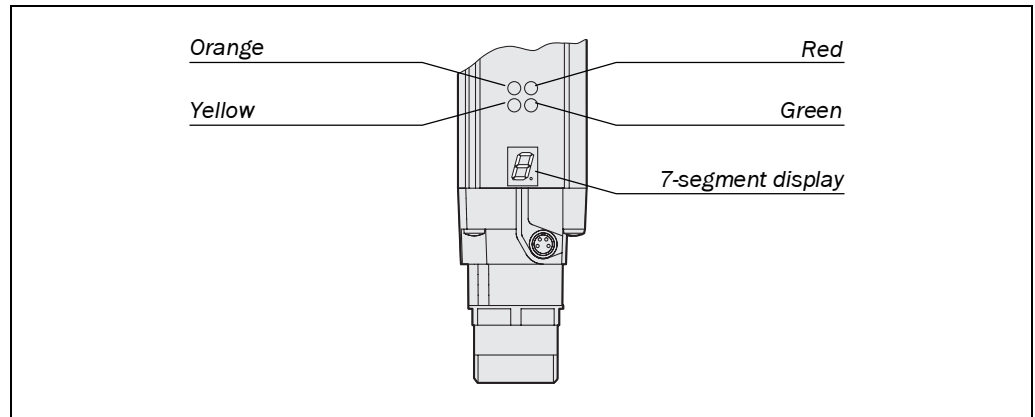
Tab. 5: Status indicators of the sender

Display	Meaning
	Yellow: Power supply OK
	System error. The device is defective. Replace the sender.
	The device is in the test mode.
	Non-coded operation (only after switching on)
	Operation with code 1 (only after switching on)
	Operation with code 2 (only after switching on)
Other displays	All other displays are error messages. Please refer to chapter "Fault diagnosis" on page 41.

C 4000

3.5.2 Status indicators of the receiver

Fig. 14: Status indicators of the receiver



Tab. 6: Status indicators elements of the receiver

Display	Meaning
	Orange: Cleaning or realignment required
	Yellow flashing: Reset required
	Red: System providing signals for shutting down the machine (switching output off)
	Green: System enabled (switching output on)
	System error. The device is defective. Replace the receiver.
	Poor alignment to sender.
	Please refer to chapter "Commissioning" on page 36.
	Operation with large protective field width (only after switching on)
	Operation with reduced resolution and/or blanking
	Non-coded operation (only after switching on)
	Operation with code 1 (only after switching on)
	Operation with code 2 (only after switching on)
Other displays	All other displays are error messages. Please refer to chapter "Fault diagnosis" on page 41.

4 Installation and mounting

This chapter describes the preparation and completion of the installation of the safety light curtain C 4000. The installation and mounting requires two steps:

- Determining the necessary safety distance
- Installation with swivel mount or side brackets

The following steps are necessary after mounting and installation:

- Making the electrical connections (chapter 5)
- Aligning sender and receiver (section 6.2)
- Checking the installation (section 6.3)

4.1 Determining the safety distance

The light curtain must be mounted with the correct safety distance

- from the point of danger
- from reflective surfaces



WARNING

No protection without correct safety distance!

The reliable protective effect of the light curtain depends on the system being mounted with the correct safety distance from the point of danger.

4.1.1 Safety distance from the point of danger

A safety distance must be maintained between the light curtain and the point of danger. This safety distance ensures that the point of danger can only be reached after the dangerous state of the machine has been completely stopped.

The safety distance as defined in EN 999 and EN 294 depends on:

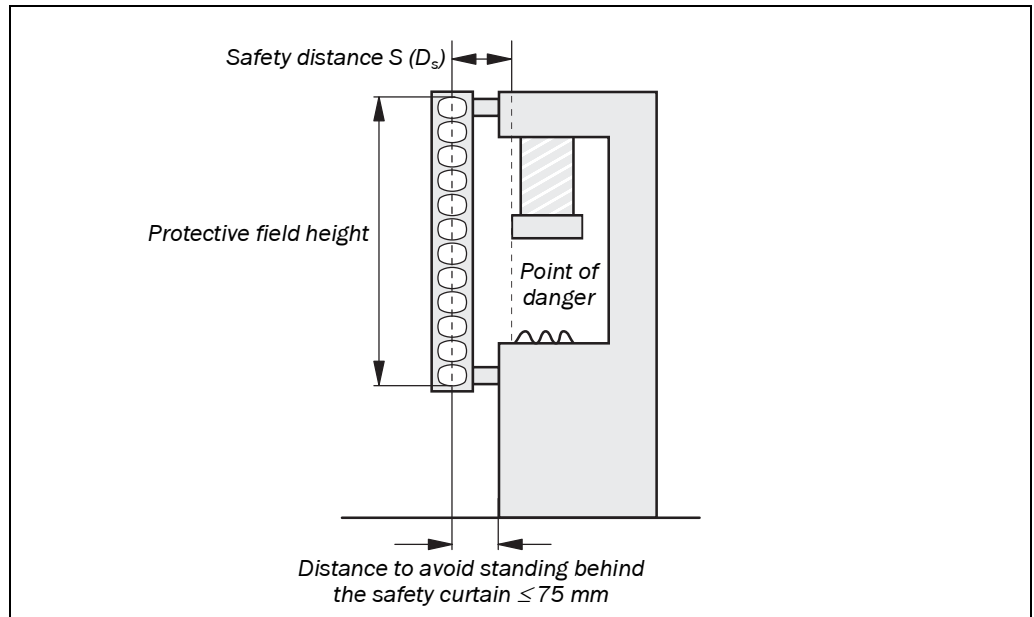
- Stopping/run-down time of the machine or system (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- Response time of the entire protective device, e.g. C 4000 consisting of host and guest (response times, see section "Response time" on page 47)
- Reach or approach speed
- Resolution of the light curtain and/or beam separation

Under the authority of OSHA and ANSI the safety distance as specified by ANSI B11.19-1990 E.4.2.3.3.5 and Code of Federal Regulations, Volume 29, Part 1910.217 ... (h) (9) (v) depends on:

- Stopping/run-down time of the machine or system (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- Response time of the entire protective device, e.g. C 4000 consisting of host and guest (response times, see section "Response time" on page 47)
- Reach or approach speed

C 4000

Fig. 15: Safety distance from the point of danger



How to calculate the safety distance S according to EN 999 and EN 294:

- First, calculate S using the following formula:

$$S = 2000 \times T + 8 \times (d - 14) \text{ [mm]}$$

Where ...

T = stopping/run-down time of the machine
+ response time of the protective device [s]

d = resolution of the light curtain [mm]

S = safety distance [mm]

The reach/approach speed is already included in the formula.

- If the result S is ≤ 500 mm, then use the determined value as the safety distance.
- If the result S is > 500 mm, then recalculate S as follows:
 $S = 1600 \times T + 8 \times (d - 14) \text{ [mm]}$
- If the new value S is > 500 mm, then use the newly determined value as the minimum safety distance.
- If the new value S is ≤ 500 mm, then use 500 mm as the safety distance.

Example:

Stopping/run-down time of the machine = 290 ms

Response time = 30 ms

Resolution of the light curtain = 14 mm

$$T = 290 \text{ ms} + 30 \text{ ms} = 320 \text{ ms} = 0.32 \text{ s}$$

$$S = 2000 \times 0.32 + 8 \times (14 - 14) = 640 \text{ mm}$$

$S > 500$ mm, therefore:

$$S = 1600 \times 0.32 + 8 \times (14 - 14) = \underline{\underline{512 \text{ mm}}}$$

How to calculate the safety distance D_s according to ANSI B11.19-1990 E.4.2.3.3.5 and Code of Federal Regulations, Volume 29, Part 1910.217 ... (h) (9) (v):

➤ Calculate D_s using the following formula:

$$D_s = H_s \times (T_s + T_c + T_r + T_{bm}) + D_{pf}$$

Where ...

D_s = The minimum distance in inches (or millimetres) from the point of danger to the detection point, plan or zone

H_s = A parameter in inches/second or millimetres/second, derived from data on approach speeds of the body or parts of the body. Often 63 inches/second is used for H_s .

T_s = Stop time of the machine tool measured at the final control element

T_c = Response time of the control system

T_r = Response time of the presence-sensing device and its interface

T_{bm} = Additional response time allowed for brake monitor to compensate for wear

Note Any additional time delays must be accounted for in this calculation.

D_{pf} = An additional distance added to the overall safety distance required. This value is based on intrusion toward the point of danger prior to actuation of the electro-sensitive protective equipment (ESPE). Values range from 0.25 inches to 48 inches or more depending on application.

Example:

In opto-electronic safeguarding, such as with a perpendicular safety light curtain applications with object sensitivity (effective resolution) less than 2.5 inches, the D_{pf} can be approximated based on the following formula:

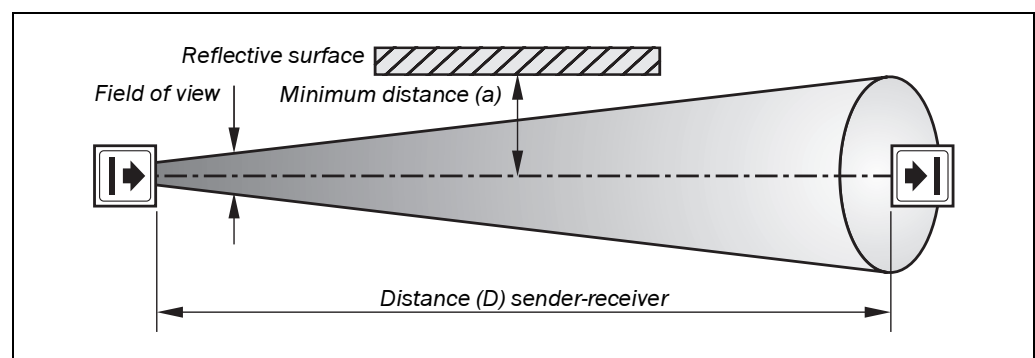
$$D_{pf} \text{ (inches)} = 3.4 \times (\text{Object Sensitivity} - 0.276), \text{ but not less than } 0.$$

4.1.2 Minimum distance from reflective surfaces

The light beams from the sender may be deflected by reflective surfaces. This can result in failure to identify an object.

All reflective surfaces and objects (e.g. material bins) must therefore be located at a minimum distance (a) from the protective field of the system. The minimum distance (a) depends on the distance (D) between sender and receiver.

Fig. 16: Minimum distance from reflective surfaces

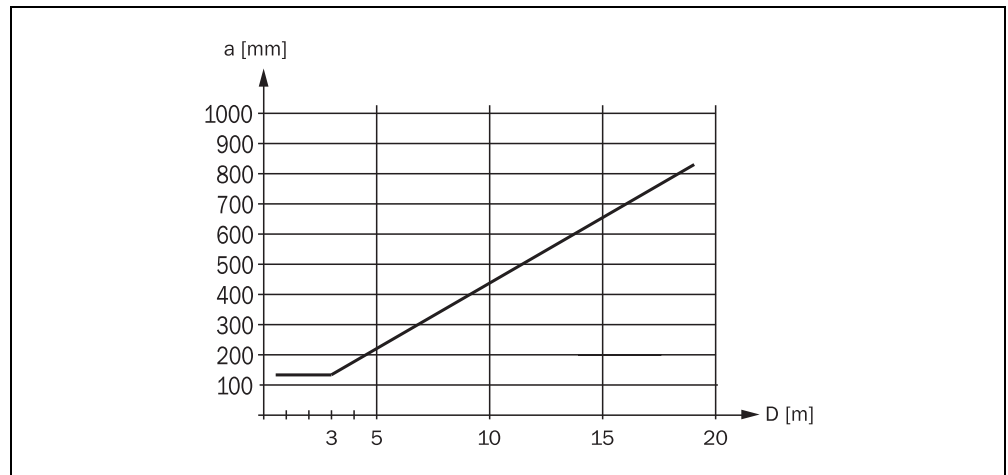


Note The field of view of the sender and receiver optics is identical.

C 4000**How to determine the minimum distance from reflective surfaces:**

- Determine the distance (D) [m] sender-receiver.
- Read the minimum distance (a) [mm] from the graph:

Fig. 17: Graph, minimum distance from reflective surfaces



4.2 Steps for mounting the device

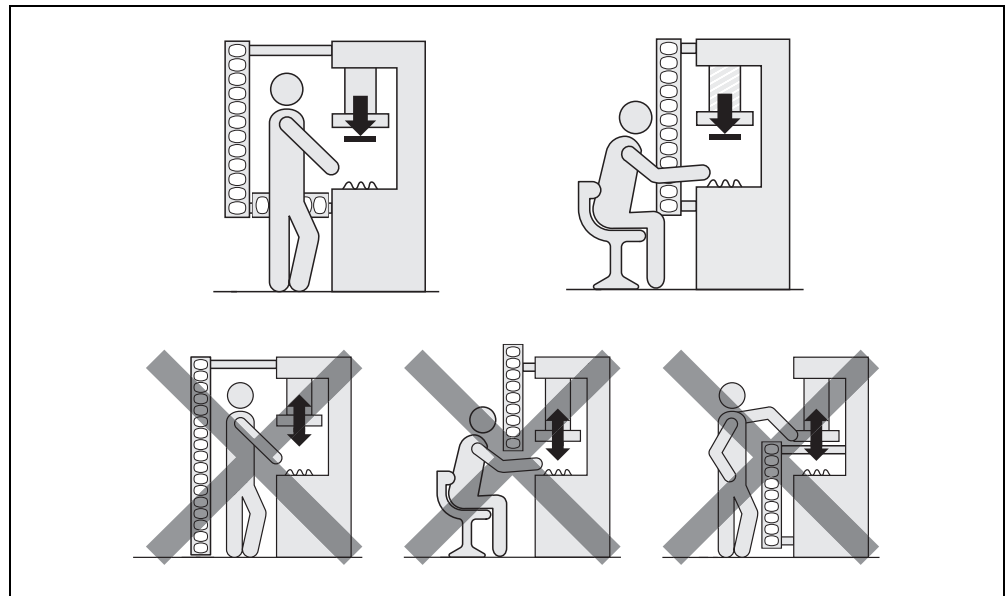


WARNING

Special features to note during mounting:

- Always mount the sender and receiver parallel to one another.
- During mounting, make sure that sender and receiver are aligned correctly. The optical lens systems of sender and receiver must be located in exact opposition to each other; the display elements must be mounted at the same height. The system plugs of both devices must point in the same direction.
- Take suitable measures to attenuate vibration if the shock requirements are above the values given in section 10.1 "Data sheet" on page 46.
- Observe the safety distance of the system during mounting. Refer to section "Determining the safety distance" on page 22.
- Connect a maximum of three systems into a cascaded system.
- Always connect sender-sender and receiver-receiver within a system configuration.
- Mount the safety light curtain such that the point of danger cannot be reached from below, above or behind the safety light curtain and that the light curtain cannot be repositioned.

Fig. 18: The correct installation (above) must eliminate the errors (below) reaching below, reaching above and reaching behind.



- Once the system is mounted, one or several of the enclosed self-adhesive safety information labels must be affixed.
 - Use only labels in the language which the operators of the machine understand.
 - Affix the information labels such that they are easily visible by the users/operators during operation. After attaching additional objects and equipment, the information labels must not be concealed from view.
 - Affix the information label "Important Notices" to the system in close proximity to sender and receiver.
 - Operation with floating blanking: Affix the information label for floating blanking to each sender or receiver so configured. Mark the effective resolution on the information label.
 - For operation with reduced resolution: Affix the information label for reduced resolution to each sender or receiver so configured. Mark the effective resolution on the information label.

The senders and receivers can be mounted in two different ways:

- Mounting with swivel mount bracket
- Mounting with side bracket

4.2.1 Mounting with swivel mount bracket

The swivel mount bracket is made of black polyamide PA6. The bracket is designed such that sender and receiver can still be accurately aligned even after the bracket has been mounted.

The swivel mount bracket is also suitable for mounting the deflector mirrors PNS 75 and PNS 125 (see section 10.4.6f. on page 54f.).

Note ➤ Attach the bolts of the swivel mount bracket with a torque of between 2.5 and 3 Nm. Higher torques can damage the bracket; lower torques provide inadequate protection against vibration.

Fig. 19: Composition of the swivel mount bracket

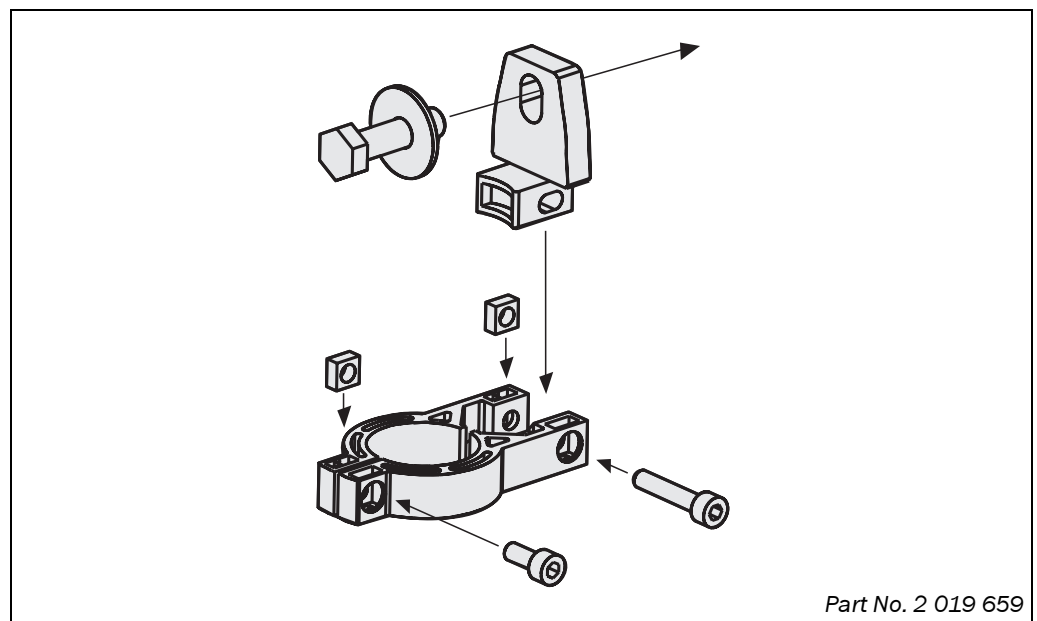
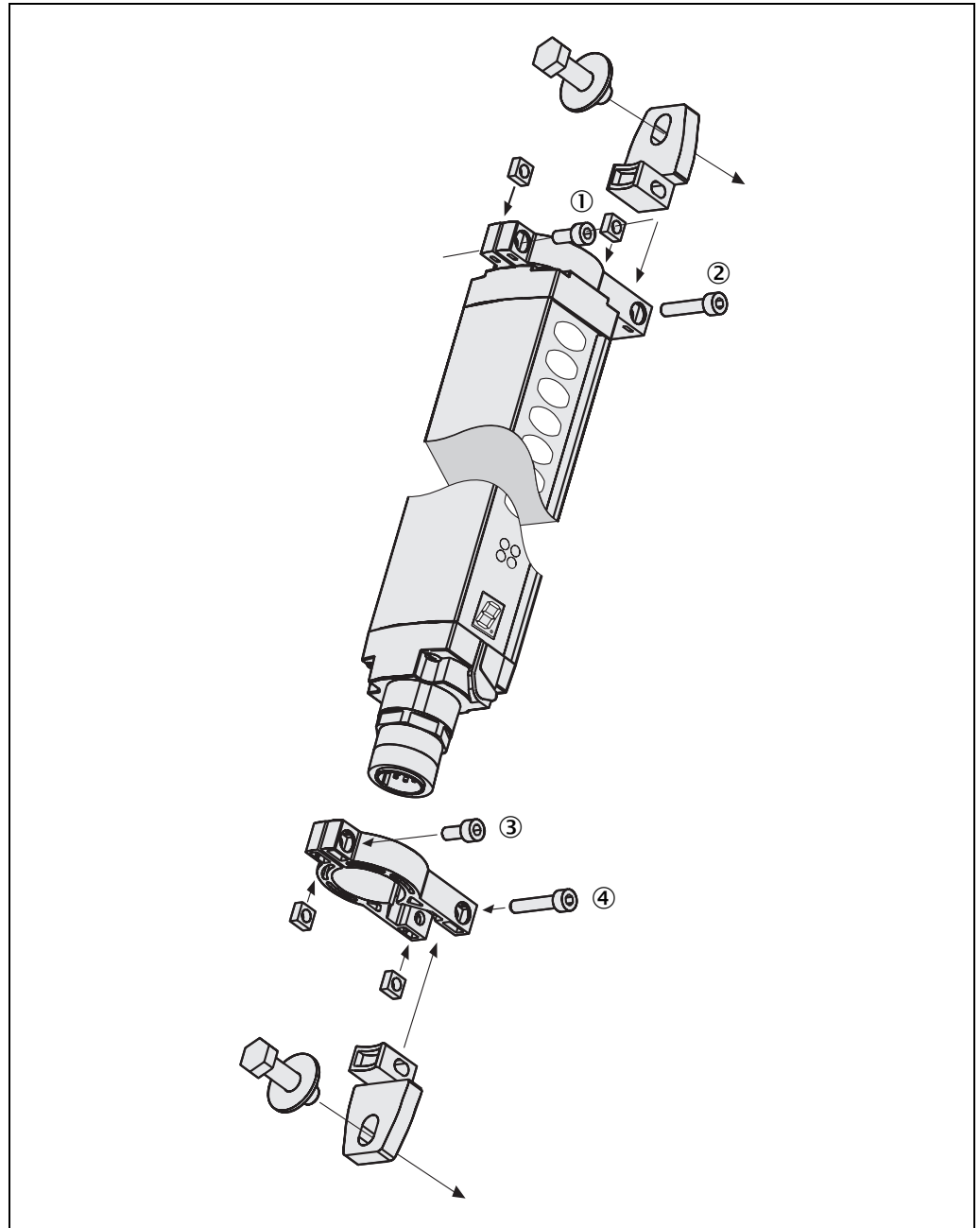


Fig. 20: Mounting sender and receiver using swivel mount brackets

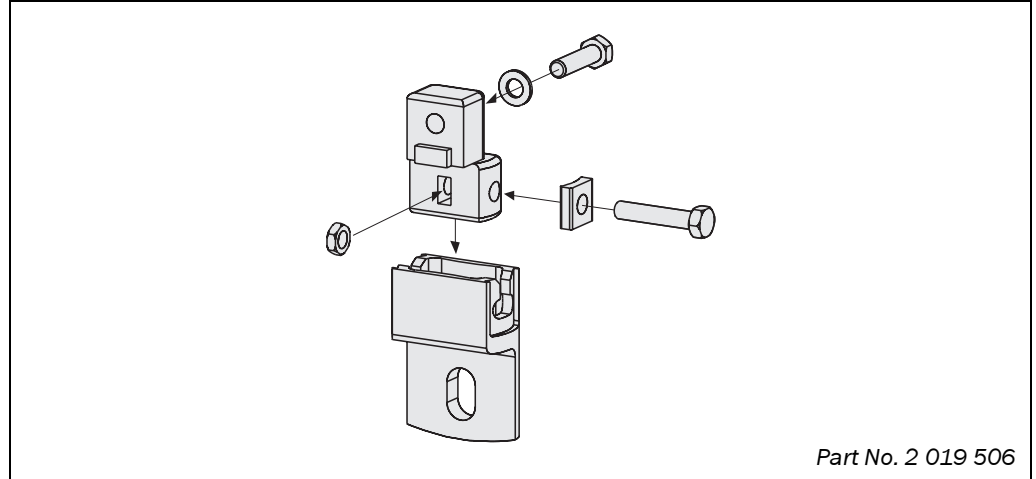


- Notes**
- Mount the bolts marked with ① to ④ on the operator side of the system to ensure that they remain accessible after mounting and to allow you to readjust the light curtain later, if necessary.
 - If you wish to use the additional front screen (see “Additional front screen (weld spark guard)” on page 64), make sure that the curved side of the device remains accessible after mounting.

4.2.2 Mounting with side bracket

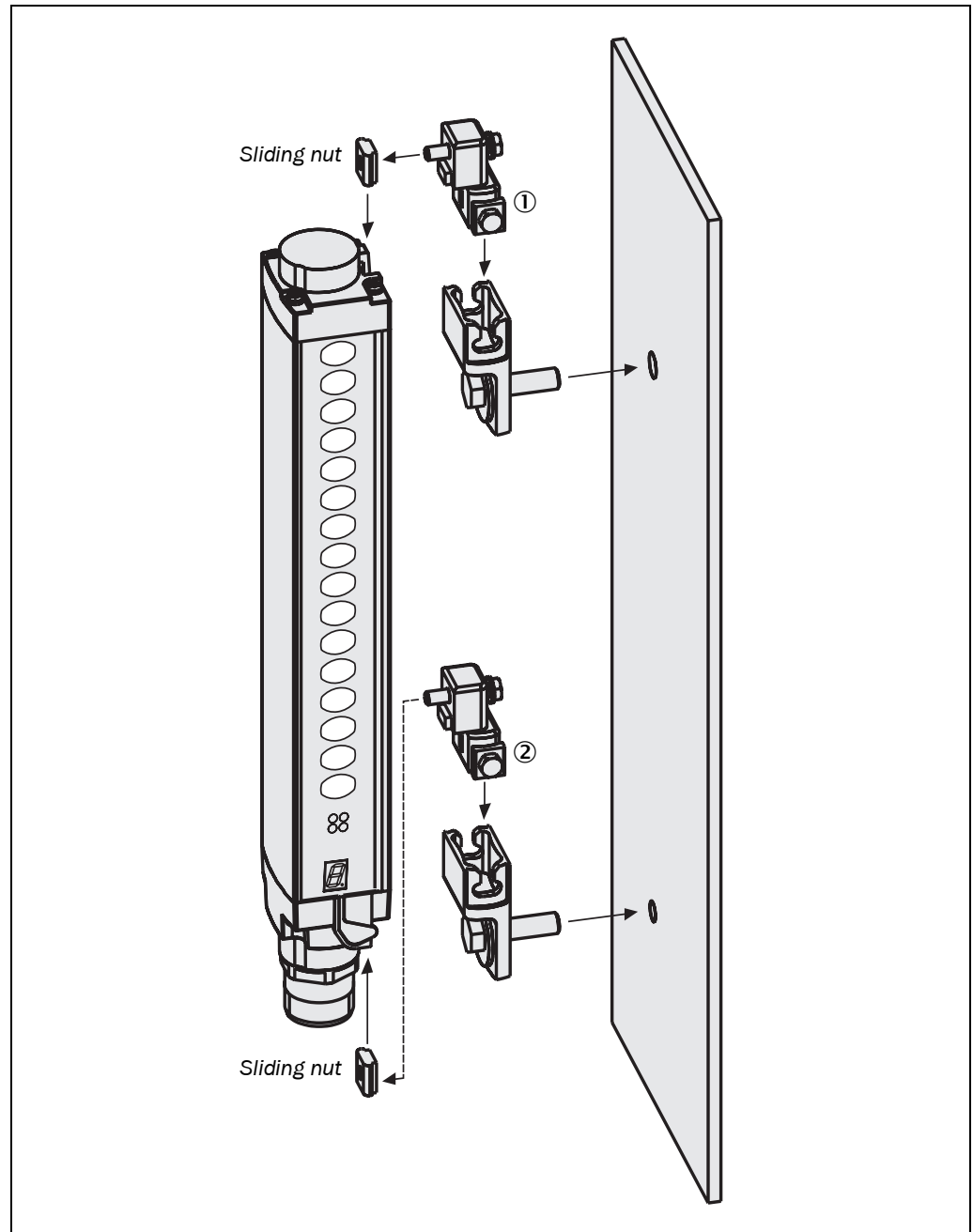
The side bracket is made of die cast zinc ZP 0400. It is enamelled in black. The side bracket will be covered by the device after mounting. But it is only suitable for mounting surfaces lying parallel to the desired protective field because the alignment of sender and receiver can only be adjusted by a maximum of $\pm 2.5^\circ$ after mounting.

Fig. 21: Composition of the side bracket



- Notes**
- Attach the bolts of the side bracket with a torque of between 5 and 6 Nm. Higher torques can damage the bracket; lower torques provide inadequate protection against vibration.
 - When mounting the bracket, note the distance and the position of the sliding nuts as described in section 10.4 "Dimensional drawings" on page 50.

Fig. 22: Mounting the C 4000 with side bracket



- Notes**
- When mounting the side bracket make sure that the bolts marked ① and ② remain accessible, allowing you later to adjust and lock the light curtain in position.
 - If you wish to use the additional front screen (see “Additional front screen (weld spark guard)” on page 64), make sure that the curved side of the device remains accessible after mounting.

5 Electrical installation



WARNING

Switch the entire machine/system off line!

The machine/system could inadvertently start up while you are connecting the unit.

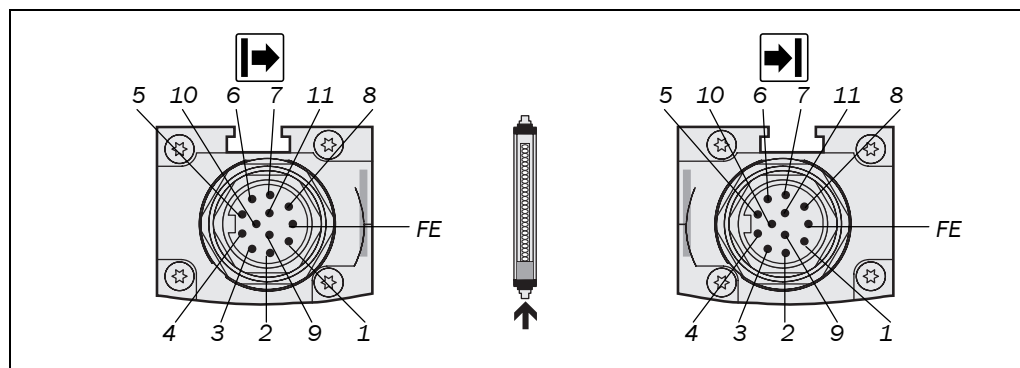
- Make sure that the entire machine/system is disconnected during the electrical installation.

Notes

- The safety light curtain is a Class A device. It may cause radio interference in residential areas. If radio interference occurs, the person(s) affected may demand that the operator take appropriate action for suppressing interference.
- To ensure full electromagnetic compatibility (EMC), functional earthing (FE) must be connected.
- The external voltage supply of the device must be capable of buffering brief mains failures of 20 ms as specified in EN 60 204. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).
- The plug alignment (direction of turn) in the housing may vary from unit to unit. You can identify the correct pin assignment by the position of the pins in relation to each other as shown in the drawings.
- System connections and extension connections in a cascaded system must be connected only if the system is off line. The RS 232 interface may be connected/disconnected with the system on line.

5.1 System connection M 26×11 + FE

Fig. 23: Pin assignment
system connection
M 26×11 + FE



Tab. 7: Pin assignment
system connection
M 26×11 + FE

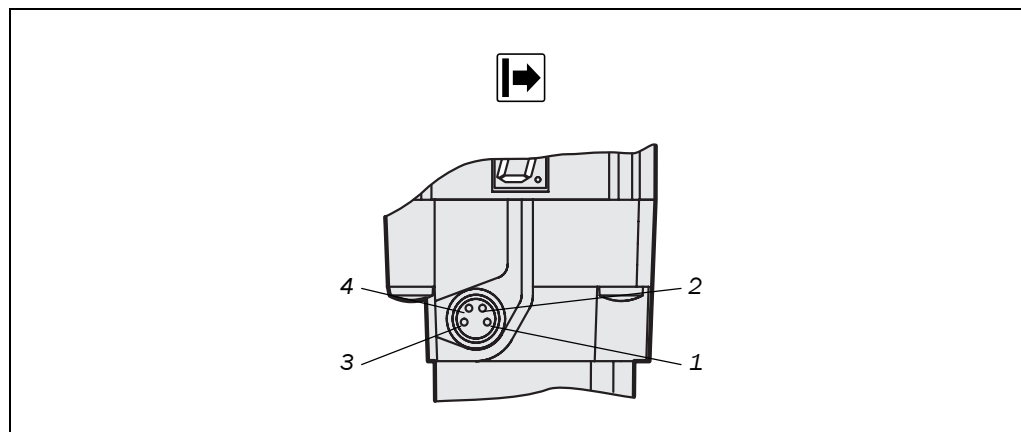
Pin	Wire colour	Sender	Receiver
1	brown	24 V DC input (voltage supply)	24 V DC input (voltage supply)
2	blue	0 V DC input (voltage supply)	0 V DC input (voltage supply)
3	grey	test input: 0 V: external test active 24 V: external test inactive	OSSD1 (switching output 1)
4	pink	reserved	OSSD1 (switching output 2)
5	red	reserved	reset/restart
6	yellow	reserved	external device monitoring (EDM)
7	white	reserved	reserved

Tab. 7: Pin assignment
system connection
M 26×11 + FE (contd.)

Pin	Wire colour	Sender	Receiver
8	red/blue	reserved	reserved
9	black	device communication	device communication
10	purple	device communication	device communication
11	grey/pink	input host/guest SEL	input host/guest SEL
FE	green	functional earthing	functional earthing

5.2 Configuration connection M 8×4 (serial interface)

Fig. 24: Pin assignment con-
figuration connection M 8×4



Tab. 8: Pin assignment con-
figuration connection M 8×4

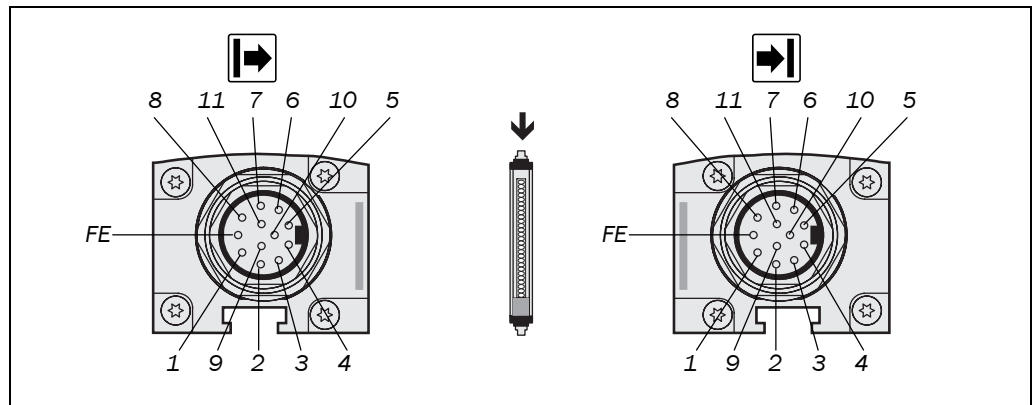
Pin	Sender/receiver	PC-side RS 232 SubD
1	not assigned	
2	RxD	pin 3
3	0 V DC (voltage supply)	pin 5
4	TxD	pin 2

Notes The pin assignment of sender and receiver is identical.

- After the configuration of the device has been completed, locate the attached protection cap to cover the configuration connection.

5.3 Extension connection M 26×11 + FE

Fig. 25: Pin assignment
extension connection
M 26×11 + FE



Tab. 9: Pin assignment
extension connection
M 26×11 + FE

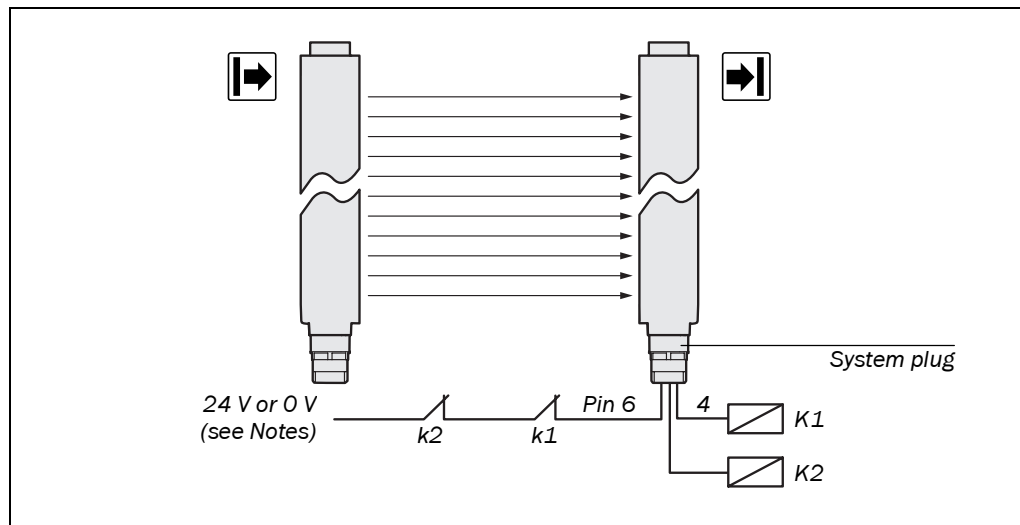
Pin	Wire colour	➡ Sender	➡ Receiver
1	brown	24 V DC output (voltage supply)	24 V DC output (voltage supply)
2	blue	0 V DC output (voltage supply)	0 V DC output (voltage supply)
3	grey	reserved	reserved
4	pink	reserved	reserved
5	red	reserved	reserved
6	yellow	reserved	reserved
7	white	reserved	reserved
8	red/blue	reserved	reserved
9	black	device communication	device communication
10	purple	device communication	device communication
11	grey/pink	output host/guest SEL	output host/guest SEL
FE	green	functional earthing	functional earthing

Note ➤ If the extension connection is no longer required, always screw the attached protective cap over the extension connection.

5.4 External Device Monitoring (EDM)

The EDM checks if the contactors actually de-energise when the protective device responds. If, after an attempted reset, the EDM does not detect a response from the switched device within 300 ms, the EDM will deactivate the OSSD switching outputs again.

Fig. 26: Connecting the contact elements to the EDM



The EDM is implemented electrically by both N/C contacts (k1, k2) having to close when the contact elements (K1, K2) reach their position of rest by interruption of the light path – 24 V then applied at the input of the EDM. If 24 V is not applied after a light path interruption, one of the contact elements is defective and the EDM prevents the machine restart.

Notes

- The EDM remains active after switching the device off and back on again. It can only be deactivated with the reset function (see page 14).



- If you connect the contact elements to be monitored to the EDM input, then you must select the operating mode **EDM** in the CDS (Configuration & Diagnostic Software). If not, the device will show the error .
- If you later deselect the EDM operating mode, pin 6 of the system plug must not remain connected to 24 V. In this case, connect pin 6 to 0 V.

5.5 Reset button/restart button

In the protective operation mode with internal restart interlock (see page 13) the operator must first press the reset/restart button before restarting.

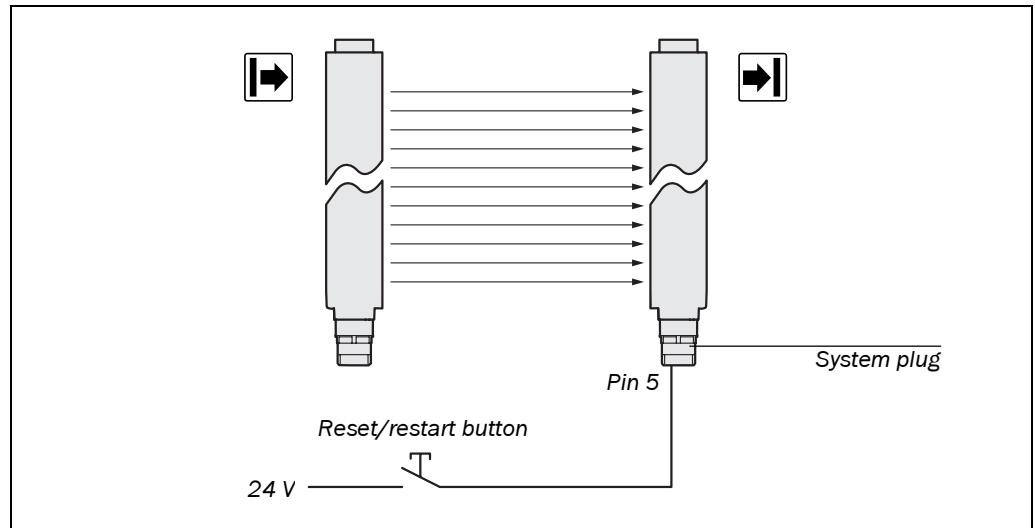


WARNING

Select the correct installation site for the reset button!

Install the reset button outside the hazardous area such that it cannot be operated from inside the hazardous area. When operating the reset button, the operator must have full visual command of the hazardous area.

Fig. 27: Connecting the reset button/restart button



WARNING

Device configuration after replacement!

If you replace a safety light curtain with active reset function with a replacement unit, the reset function must again be activated via the software. It is not sufficient to make the electrical connections, because new devices are supplied ex factory with deactivated reset function.

6 Commissioning



WARNING

Commissioning requires a thorough check-up by qualified personnel!

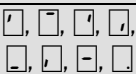









Before you operate a system protected by the safety light curtain C 4000 for the first time, make sure that the system is first checked and approved by qualified personnel. Please read the notes in the chapter “On safety” on page 8.

6.1 Display sequence during power-up

After the system is activated, sender and receiver go through the power-up cycle. The 7-segment display indicates the device status during the power-up cycle.

The display values have the following meaning:

Tab. 10: Displays shown during the power-up cycle

Display	Meaning
	Testing the 7-segment display. All segments are activated sequentially.
	Approx. 0.5 s. Is displayed only at the receiver and only in operation with large scanning range.
	Approx. 0.5 s. System operates as host () or as guest 1 () or guest 2 () in a cascaded system.
	Approx. 0.5 s. Non-coded operation or operation with code 1 or 2.
No display or 	The device is operational. Display  appears if the device is operated with reduced resolution and/or with blanking.
	Receivers only: Receiver-sender alignment incorrect (see “Aligning sender and receiver” below).
Other display	Device error. See “Fault diagnosis” on page 41.

6.2 Aligning sender and receiver

After the light curtain has been mounted and connected, the sender and receiver must be aligned in relation to each other. The light beams emitted by the sender must hit the receiver with a degree of accuracy.

Note If you wish to align a cascaded system, always align the individual systems in the following sequence: host, guest 1, guest 2.

How to align sender and receiver in relation to each other:



WARNING

Secure the plant/system. No dangerous movement possible!






Make sure that the dangerous state of the machine is (and remains) switched off! During the alignment process, the outputs of the safety light curtain are not allowed to have any effect on the machine.

- Loosen the clamping bolts which hold the light curtain in place.
- Switch on the power supply to the light curtain.
- Watch the alignment information on the 7-segment display of the receiver (see Tab. 11). Correct the alignment, until the 7-segment display goes off.
- Using the clamping bolts, fix the light curtain in place.

Tab. 11: Display values during the alignment of sender and receiver

- Switch the power supply off and then back on again and check via the 7-segment display whether the alignment is correct after tightening the clamping bolts (Tab. 11).

The display values have the following meaning:

Display	Meaning
	The receiver cannot synchronise with the sender; the alignment is very poor.
	Some light beams do not hit the receiver.
	All the light beams hit the receiver, but the alignment is still slightly off.
No display or 	The alignment is now true; the devices must be locked in this position. Display  appears if the device is operated with reduced resolution and/or with blanking.

- Notes**
- If the optimum alignment (= no display) persists for longer than 2 minutes, the system automatically deactivates the alignment mode.
 - If you wish to readjust the alignment later, switch the power supply of the C 4000 off and back on again.
 - The host in a cascaded system remains on red until all guests have been correctly aligned.

6.3 Test notes

6.3.1 Tests before the first commissioning

The purpose of the tests before the first commissioning is to confirm the safety requirements specified in the national/international rules and regulations, especially in the Machine and Equipment Usage Directive (EU Conformity).

- Check the effectiveness of the protective device mounted to the machine, using all selectable operating modes as specified in the checklist in the annex (see 12.2 on page 68).
- Make sure that the operating personnel of the machine safeguarded by the light curtain are properly instructed by specialist personnel before being allowed to operate the machine. Instructing the operating personnel is the responsibility of the machine operator.
- Annex 12.2 of this document shows a checklist for review by the manufacturer and OEM. Use this checklist as a reference before commissioning the system for the first time.

6.3.2 Regular inspection of the protective device by qualified personnel


- Check the system, following the inspection intervals specified in the national rules and regulations. This procedure ensures that any changes on the machine or manipulations of the protective device are detected before use/re-use.
- If any modifications have been made to the machine or the protective device, or if the safety light curtain has been changed or repaired, the system must be checked again as specified in the checklist in the annex.

6.3.3 Daily functional checks of the protective device

The effectiveness of the protective device must be checked daily by a specialist or by authorized personnel, using the correct test rod.

Note Always test along the complete hazardous area to be protected, never solely at the mounting position of the light curtain.

How to check the effectiveness and proper function of the safety light curtain:

➤ Select the correct test rod depending on device resolution. If you operate the unit with reduced resolution (display  on the receiver), select the test rod using the following table:

Tab. 12: Selecting the test rod under reduced resolution

Physical resolution	Reduction	Effective resolution
14 mm	1 beam	22 mm
	2 beams	30 mm
	3 beams	37 mm
20 mm	1 beam	30 mm
	2 beams	40 mm



WARNING

Do not operate the machine if the green or yellow LED is lit during the test!

If the green or yellow LED lights up *during the test* even for a short period, work must stop at the machine. In this case the installation of the safety light curtain must be checked by specialized personnel (see chapter 4).

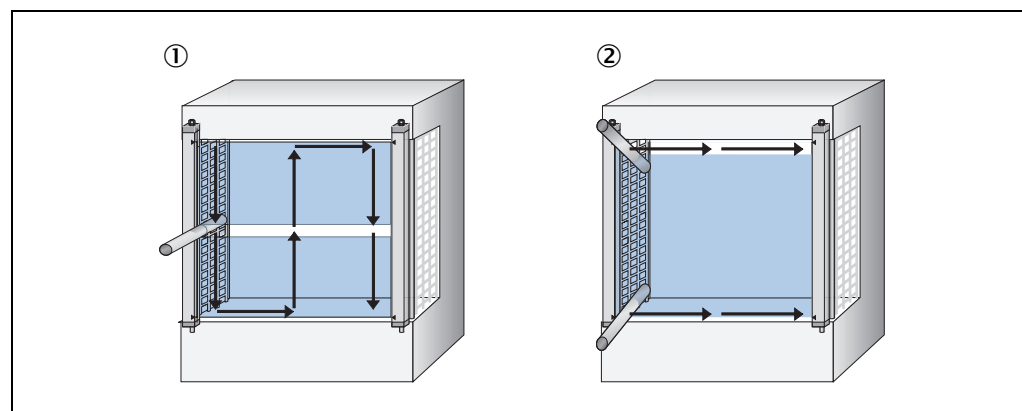
➤ Before inserting the test rod, check that the green LED is lit if the internal restart interlock is deactivated and that the yellow LED flashes ("Reset required"). If this is not the case, make sure that this condition is reached. The test is otherwise meaningless.

➤ Move the test rod slowly through the protective field to be tested, as shown in ① in Fig. 28.

➤ Then move the test rod along the edges of the protective field, as shown in ② in Fig. 28. This procedure allows you to test if the point-of-operation guard/reaching behind protection is functioning properly (see 4.2 "Steps for mounting the device" on page 26).

Note In both tests, the receiver of the C 4000 must show the red LED only.

Fig. 28: Daily checks of the protective device



7 Configuration

7.1 Delivery status

As delivered the C 4000 is configured ready for protective operation. Standard systems without function package B are optionally available with the pre-configurations C, D, E and F.

Tab. 13: Delivery status of the C 4000

Function that can be configured	C 4000 standard/ C 4000 with function package B	C 4000 without function package, with pre-configuration ...			
		C	D	E	F
Restart interlock	machine-side	machine-side		internal	
EDM	none	selected			
Beam coding	none	none			
Blanking	none	none			
Scanning range					
0–2.5 m or 0–6 m	■	■		■	
2–6 m or 2.5–19 m			■		■

7.2 Preparing the configuration

How to prepare the configuration:

- Make sure that the safety light curtain has been correctly mounted and that the electrical connections are correct and in place.
- Plan all required settings (operating mode, beam coding, resolution, cascading etc.)

To configure the safety light curtain, you need:

- CDS (Configuration & Diagnostic Software) on CD-ROM
 - User manual for CDS on CD-ROM
 - PC/Notebook with Windows 9x/NT 4/2000 Professional and a serial interface (RS 232). PC/Notebook not included
 - Connecting cable between PC and C 4000
- To configure the device, please read the user manual for the CDS (Configuration & Diagnostic Software) and use the online help function of the programme.

8 Care and maintenance

The safety light curtain C 4000 is maintenance-free. The front screen of the safety light curtain C 4000 and any additional front screen(s) (see “Additional front screen (weld spark guard)” on page 64) should be cleaned at regular intervals and when dirty.

- Do not use aggressive cleaning agents.
- Do not use abrasive cleaning agents.

Note Static charges cause dust particles to be attracted to the front screen. You can prevent this effect by using the antistatic plastic cleaner (SICK Part No. 5 600 006) and the SICK lens cloth (Part No. 4 003 353).

How to clean the front screen and/or the additional front screen (optional extra):

- Use a clean and soft brush to remove dust from the front screen.
- Then wipe the front screen with a clean and damp cloth.

Note ➤ After cleaning, check the position of sender and receiver to make sure that the protective device cannot be bypassed (reaching over, under or behind).

➤ Verify the effectiveness of the protective device as described in section 6.3 “Test notes” on page 37.

9 Fault diagnosis

This chapter describes how to identify and remedy errors and malfunctions during the operation of the safety light curtain.

9.1 What to do in case of faults



WARNING

Cease operation if the cause of the malfunction has not been clearly identified!

Stop the machine if you cannot clearly identify or allocate the error and if you cannot safely remedy the malfunction.





9.2 SICK Support

If you cannot remedy an error with the help of the information provided in this chapter, please contact your local SICK agency.

9.3 Error displays of the LEDs

This section explains the meaning of the error displays of the LEDs and how to respond. Please refer to the description in the section “Indicator elements” on page 20.

















Tab. 14: Error displays of the LEDs

Display	Cause	Remedying the error
 Orange LED of receiver lights up	Weak signal	<ul style="list-style-type: none"> ➤ Check the alignment of sender and receiver. ➤ Check the front screen (dirt) and clean, if necessary.
 Yellow LED of receiver flashes	Reset required	<ul style="list-style-type: none"> ➤ Press the reset button.
 Yellow LED of sender fails to light up  Neither the red nor the green receiver LED lights up	No operating voltage, or voltage too low	<ul style="list-style-type: none"> ➤ Check the voltage supply and activate, if necessary.

9.4 Error displays of the 7-segment display

This section explains the meaning of the error displays of the 7-segment display and how to respond to the messages. Please refer to section "Indicator elements" on page 20 for a description of the 7-segment display.






Tab. 15: Error displays of the 7-segment display

Display	Cause	Remedying the error
 or 	Poor alignment	➤ Re-align sender and receiver (see page 36). The display goes off after 2 minutes.
	Configuration incomplete ¹⁾	➤ The display goes off automatically once the configuration has been successfully transferred. If display  does not go off: ➤ Check the configuration of the system using the CDS (Configuration & Diagnostic Software). ➤ Re-transfer the corrected configuration to the system.
 or 	EDM error	➤ Check the contactors and their wiring, eliminate any wiring errors, if necessary. ➤ If  is displayed, switch the device off and back on again.
	Error in reset button/restart button	➤ Check the reset button/restart button for proper function. The button may be defective or stuck. ➤ Check the wiring of the reset button/restart button for any short circuit to 24 V.
	System error	➤ Replace the unit (receiver or sender).
	Overcurrent at switching output 1	➤ Check the contactor. Replace, if necessary. ➤ Check the wiring for short-circuit to 0 V.
	Short circuit at switching output 1	➤ Check the wiring for short-circuit to 24 V.
	Short circuit at switching output 1	➤ Check the wiring for short-circuit to 0 V.
	Overcurrent at switching output 2	➤ Check the contactor. Replace, if necessary. ➤ Check the wiring for short-circuit to 0 V.
	Short circuit at switching output 2	➤ Check the wiring for short-circuit to 24 V.
	Short circuit at switching output 2	➤ Check the wiring for short-circuit to 0 V.
	Short circuit between switching output 1 and 2	➤ Check the wiring and rectify the error.

¹⁾ This error display can occur in a cascaded system also as a consequence of a voltage dip at a sender.

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Tab. 15: Error displays of the 7-segment display (contd.)

Display	Cause	Remedying the error
	Invalid configuration of the EDM	➤ Verify that the machine-side EDM is connected correctly.
	External sender detected	➤ Check the distance from reflective surfaces (page 24) or from other light curtains. ➤ If necessary, re-configure the device with another beam coding (page 14) or install non-reflective partitions.
	Connection problem between host and guest	➤ Check the connection between the cascaded devices. If necessary, replace defective cables.
	Communication in cascaded system failed	➤ Verify the configuration of the system using the CDS (Configuration & Diagnostic Software). Retransfer the corrected configuration to the system. ➤ Check the connection between the cascaded devices. If necessary, replace defective cables.
	Supply voltage too low	➤ Check the supply voltage and the power supply. If necessary, replace defective components. ➤ Switch the device off and back on again.

9.5 Extended diagnosis

The CDS software supplied with the device (Configuration & Diagnostic Software) includes extended diagnostic options. It allows you to narrow down the problem if the error is non-specific or if you experience usage downtime problems. Detailed information to be found

- in the online help function of the CDS (Configuration & Diagnostic Software)
- in the user manual for the CDS

10 Technical specifications

10.1 Data sheet

Tab. 16: Technical specifications C 4000

	minimum	typical	maximum
General system data			
Protective field height, depending on type	300 mm to 1800 mm		
Resolution, depending on type	14 mm to 40 mm		
Protective field width			
Resolution 14 mm	0 m		6 m
Resolution 20, 30 or 40 mm	0 m		19 m
Protection class (VDE 106)	III		
Enclosure rating	IP 65		
Supply voltage U_V at appliance ¹⁾	19.2 V	24 V	28.8 V
Residual ripple ²⁾			± 10 %
Synchronisation	Optical, without separate synchronisation		
Safety category (EN 61496)	Type 4		
Power-up delay of sender and receiver before ready			8 s
Sender unit			
Test input			
Input resistance (High)			10 kΩ
Sender inactive (Test)	-1 V	0 V	5 V
Sender active (High)	15 V	24 V	28.8 V
Response time to test	Depending on number of beams		
Wavelength of sender	940 nm		
Power consumption			2 A (host/guest/guest)
Weight	Depending on protective field height (see page 49)		

¹⁾ The external voltage supply must be capable of buffering brief mains failures of 20 ms as specified in EN 60204. Suitable power supplies are available as accessories from SICK (Siemens type series 6 EP 1).

²⁾ Within the limits of U_V .

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Tab. 16: Technical specifications C 4000 (contd.)

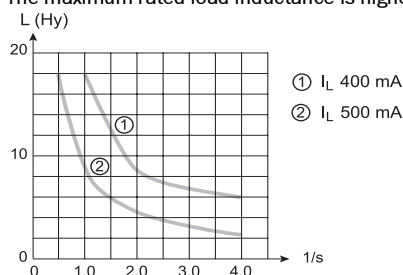
	minimum	typical	maximum
Receiver unit			
Switching outputs (OSSDs)	2 PNP semiconductor, short-circuit protected ¹⁾ , cross-circuit monitored		
Response time	See section 10.2 on page 47		
Switching voltage HIGH active (U_{eff}) ²⁾	15 V	24 V	28.8 V
Switching voltage LOW	0 V	0 V	3.5 V
Switching current		500 mA	
Leakage current ³⁾			0.25 mA
Load capacity			2.2 μF
Switching sequence	Depending on load inductance		
Load inductance ⁴⁾			2.2 H
Test pulse data ⁵⁾			
Test pulse width	120 μs	150 μs	300 μs
Test pulse rate	3 $1/\text{s}$	5 $1/\text{s}$	10 $1/\text{s}$
Permissible line resistance between device and load ⁶⁾			2.5 Ω
Supply lead			1 Ω
ON time after light beam interruption			double response time
Power consumption			3 A (host/guest/guest)
Contactors			
Permissible dropout time			300 ms
Permissible response time			300 ms
Control switch input ⁷⁾	15 V	24 V	28.8 V
Weight	Depending on protective field height (see page 49)		

¹⁾ Applies to the voltage range between U_V and 0 V.

²⁾ In compliance with IEC 61131.

³⁾ In case of malfunction (disruption of 0 V lead) the output acts like a resistor > 13 k Ω after U_V . The downstream controller must detect this status as LOW. A safe SPC (Stored-Programme Controller) must be able to identify this status.

⁴⁾ The maximum rated load inductance is higher with lower switching sequence.



⁵⁾ When active, the outputs are tested cyclically (brief LOW). When selecting the downstream controllers, make sure that the test pulses do not result in deactivation when using the above parameters.

⁶⁾ Make sure to limit the individual line core resistance to the downstream controller to this value to ensure that a short-circuit between the outputs is safely detected. (Also note EN 60 204 Electrical Machine Equipment, Part 1: General Requirements.)

⁷⁾ In compliance with IEC 61 131-2.

Tab. 16: Technical specifications C 4000 (contd.)

minimum	typical	maximum
---------	---------	---------

Operating data

Connection	Hirschmann plug M 26×11 + FE		
Cable length	Depending on load, power supply and wire cross-section. The technical specifications must be observed.		
Wire cross-section ¹⁾		0.75 mm ²	
Ambient operating temperature	0 °C		+55 °C
Air humidity (non-dewing)	15 %		95 %
Storage temperature	–25 °C		+70 °C
Housing cross-section	40 mm × 48 mm		
Rigidity	5 g, 10–55 Hz acc. to IEC 68-2-6		
Shock resistance	10 g, 16 ms acc. to IEC 68-2-29		

¹⁾ Maximum cable length ≤ 50 m.

10.2 Response time

The response time depends on the following parameters:

- Number of beams
- Beam coding
- Configuration of floating blanking
- Number of cascaded systems

How to determine the response time of the system:

- Read the response times of the individual systems (shown on type plate). Note whether the system is operated with or without beam coding.

Note

If you are planning the application without actually having any devices available, you may also determine the response time using Tab. 18 and Tab. 19. When determining the number of beams in Tab. 18, the physical resolution is important. The physical resolution of the light curtain does not change even if fixed or floating blanking has been selected.

- Fill out the following table to determine the total response time.

Tab. 17: Determining the total response time of a system

Line	Required detail		Response time
1	Host		ms
2	Guest 1		+ ms
3	Guest 2		+ ms
4	Only if floating blanking is used:	Greatest response time from lines 1 to 3: _____ × 0.5 =	+ ms
		Deduct 4 ms here.	- ms
5	If single guest is used, then add 8 ms here. (If no guest is used or two guests are used, do not add anything here.)		+ ms
6	Total response time: Sum of all lines (The total response time must be ≤ 108 ms!)		= ms

- Verify that the total response time determined is ≤ 108 ms. EN 61496 does not permit response times exceeding 108 ms. If necessary, adjust the configuration.

Example

Calculating the response time for a cascaded system with beam coding in which fields are configured with floating blanking:

Line	Required detail		Response time
1	Host: 750 mm protective field height, resolution 14 mm		16 ms
2	Guest 1: 600 mm protective field height, resolution 20 mm		+ 13 ms
3	Guest 2: —		+ 0 ms
4	Only if floating blanking is used:	Greatest response time from lines 1 to 3: <u>16 ms</u> × 0.5 =	+ 8 ms
		Deduct 4 ms here.	- 4 ms
5	If single guest is used, then add 8 ms here. (If no guest is used or two guests are used, do not add anything here.)		+ 8 ms
6	Total response time: Sum of all lines		= 41 ms

Tab. 18: Number of beams depending on the protective field height and the physical resolution

Protective field height [mm]	Number of beams for physical resolution			
	14 mm	20 mm	30 mm	40 mm
300	40	30	15	10
450	60	45	23	15
600	80	60	30	20
750	100	75	38	25
900	120	90	45	30
1050	140	105	53	35
1200	160	120	60	40
1350	180	135	68	45
1500	200	150	75	50
1650	220	165	83	55
1800	240	180	90	60

Tab. 19: Response time as factor of the number of beams

Number of beams	Without beam coding	With beam coding
10	9 ms	11 ms
15	10 ms	12 ms
20	10 ms	13 ms
23	10 ms	14 ms
25	10 ms	14 ms
30	11 ms	15 ms
35	11 ms	16 ms
38	11 ms	17 ms
40	11 ms	17 ms
45	12 ms	18 ms
50	12 ms	19 ms
53	12 ms	20 ms
55	12 ms	20 ms
60	13 ms	21 ms
68	13 ms	22 ms
75	14 ms	24 ms
80	14 ms	25 ms
83	14 ms	25 ms
90	15 ms	27 ms
100	16 ms	29 ms
105	16 ms	30 ms
120	17 ms	33 ms
135	18 ms	36 ms
140	19 ms	37 ms
150	19 ms	39 ms
160	20 ms	40 ms
165	20 ms	41 ms
180	22 ms	44 ms
200	23 ms	48 ms
220	24 ms	52 ms
240	26 ms	56 ms

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10.3 Table of weights

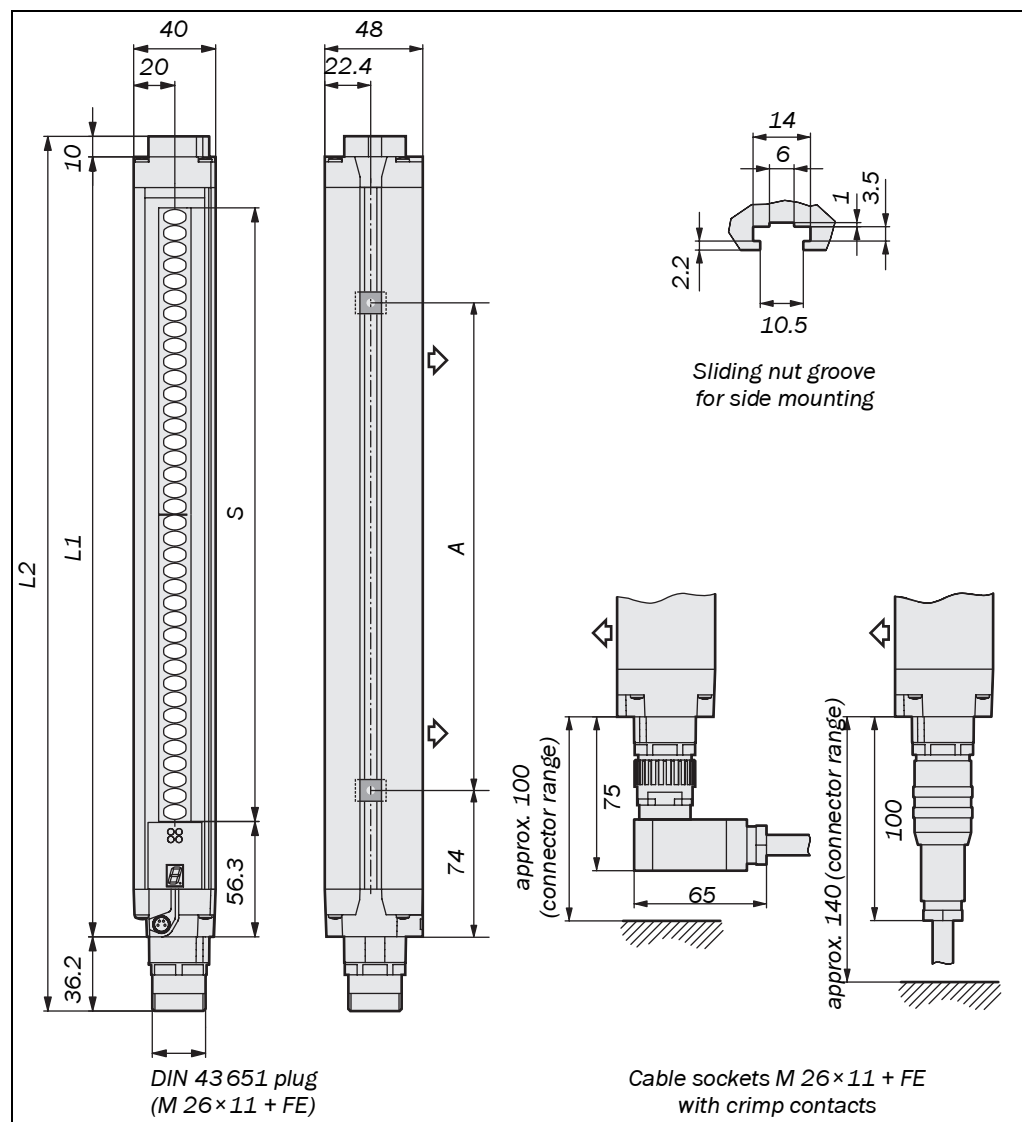
Tab. 20: Weight of sender and receiver

Protective field height [mm]	Weight [g]	
	➡ Sender	➡ Receiver
300	820	850
450	1100	1130
600	1390	1420
750	1670	1700
900	1960	1990
1050	2250	2280
1200	2530	2560
1350	2820	2850
1500	3110	3140
1650	3390	3420
1800	3680	3710

10.4 Dimensional drawings

10.4.1 Standard system (not cascable)

Fig. 29: Dimensional drawing
C 4000 sender, standard
system (not cascable).
Receiver, mirror image



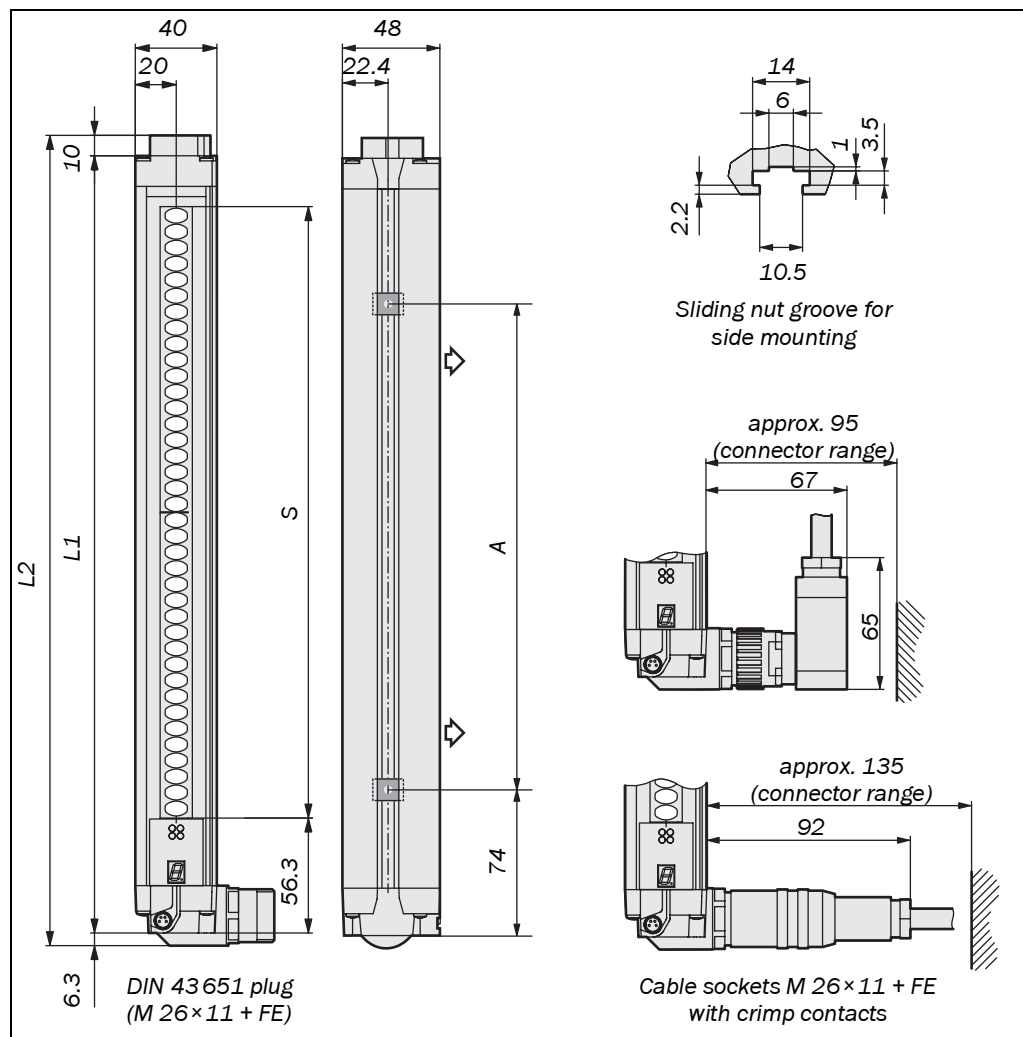
Tab. 21: Dimensions
depending on protective
field height, standard
system (not cascable)

Protective field height S [mm]	Dimensions L1 [mm]	Dimensions L2 [mm]	Dimensions A [mm]
300	381	427	224
450	532	578	374
600	682	728	524
750	833	879	674
900	984	1030	824
1050	1134	1180	974
1200	1283	1329	1124
1350	1435	1481	1274
1500	1586	1632	1424
1650	1736	1782	1574
1800	1887	1933	1724

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10.4.2 Standard system with angled system connection (not cascable)

Fig. 30: Dimensional drawing C 4000 sender, standard system with angled system connection (not cascable). Receiver, mirror image



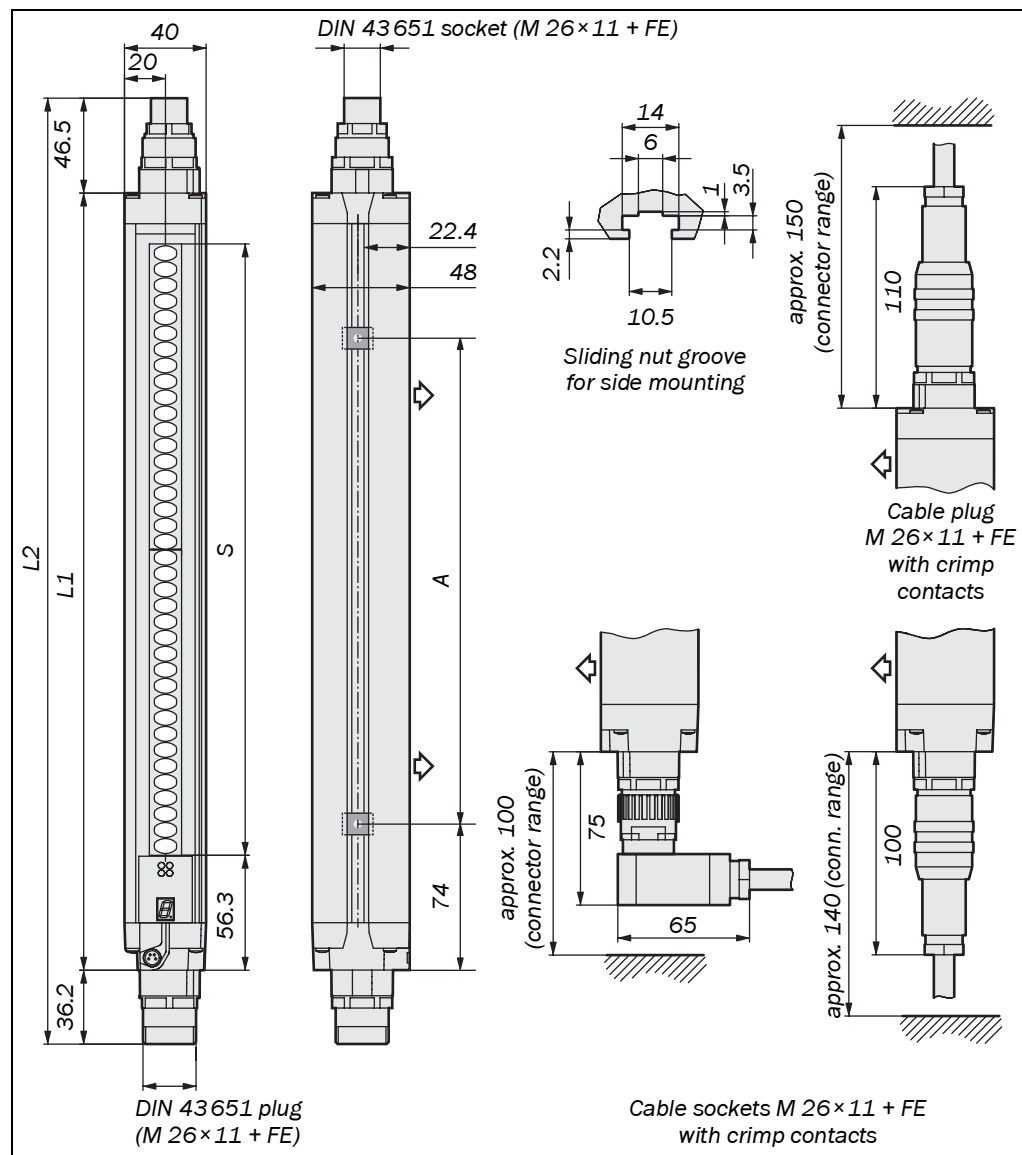
Tab. 22: Dimensions depending on protective field height S, standard system with angled system connection (not cascable)

Protective field height S [mm]	Dimensions L1 [mm]	Dimensions L2 [mm]	Dimensions A [mm]
300	381	397	224

Other systems on request.

10.4.3 Cascadable system

Fig. 31: Dimensional drawing C 4000 sender, cascadable system.
Receiver, mirror image



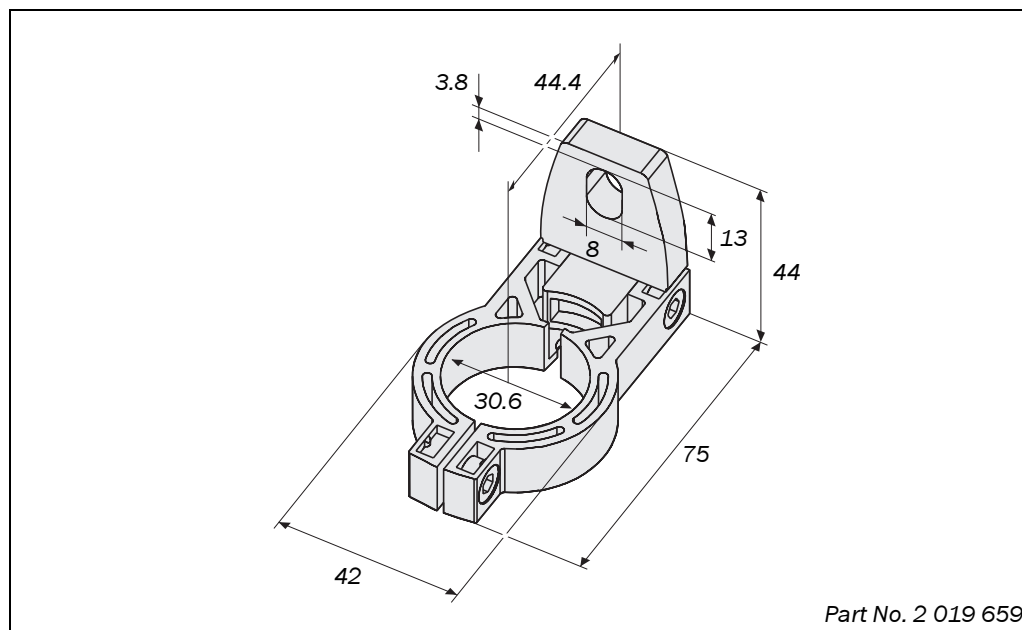
Tab. 23: Dimensions depending on protective field height, cascadable system

Protective field height S [mm]	Dimensions L1 [mm]	Dimensions L2 [mm]	Dimensions A [mm]
300	381	464	224
450	532	614	374
600	682	765	524
750	833	915	674
900	984	1066	824
1050	1134	1216	974
1200	1283	1366	1124
1350	1435	1517	1274
1500	1586	1669	1424
1650	1736	1818	1574
1800	1887	1969	1724

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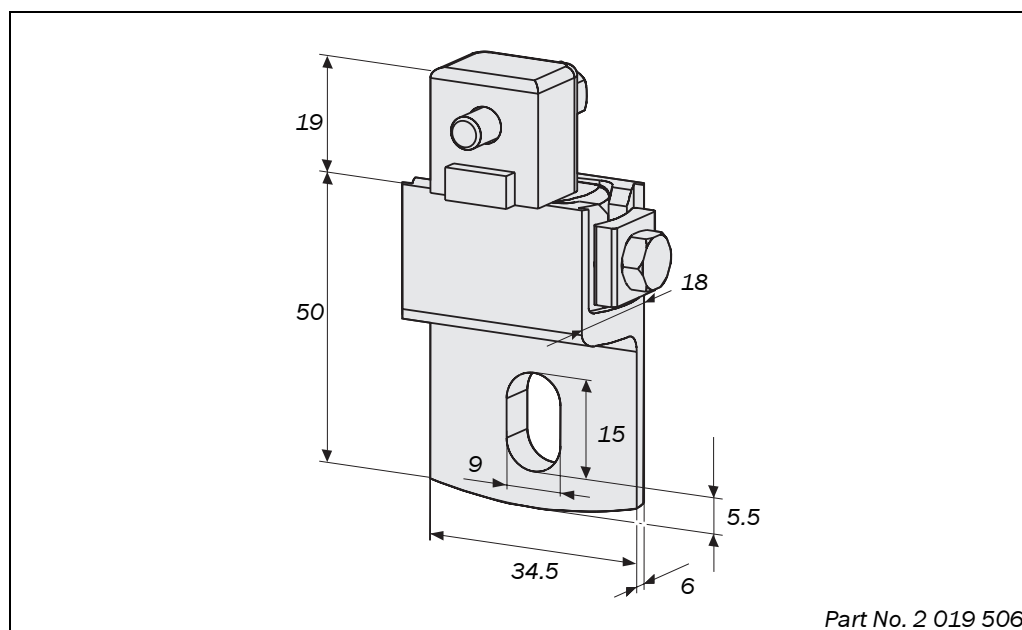
10.4.4 Swivel mount bracket

Fig. 32: Dimensional drawing, swivel mount bracket (mm)



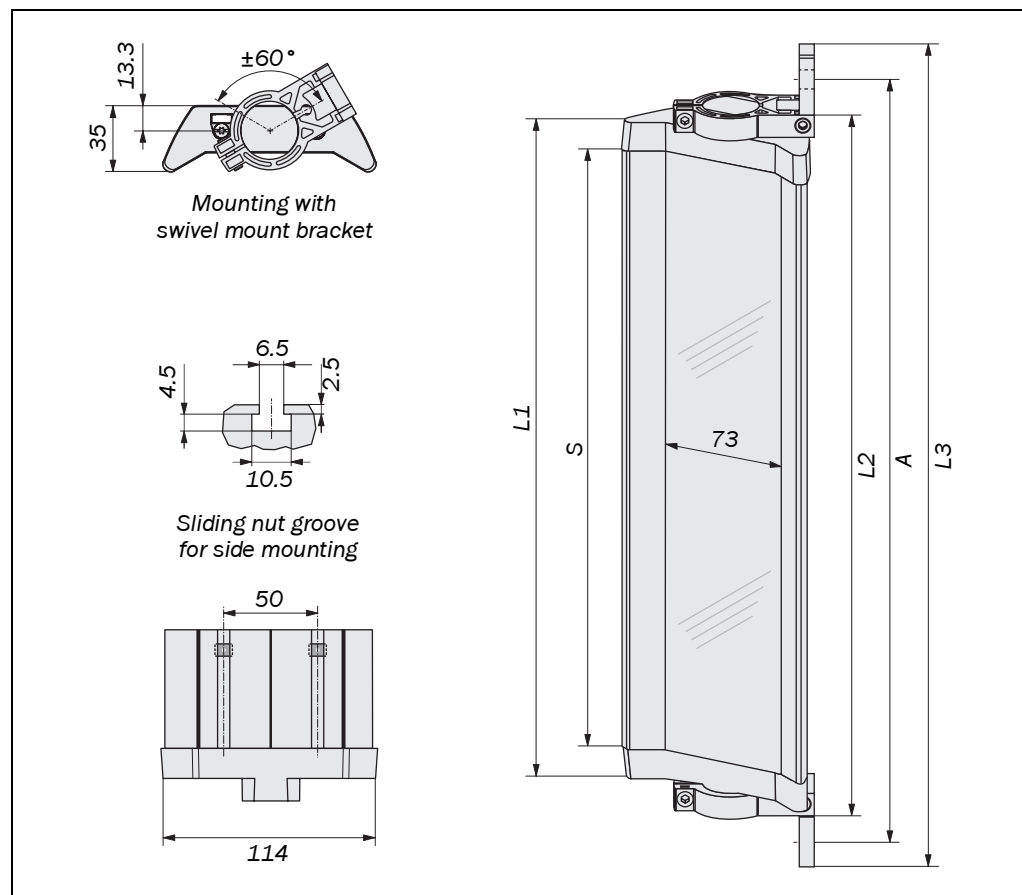
10.4.5 Side bracket

Fig. 33: Dimensional drawing, side bracket (mm)



10.4.6 Deflector mirror PNS 75

Fig. 34: Dimensional drawing deflector mirror PNS 75 (mm)



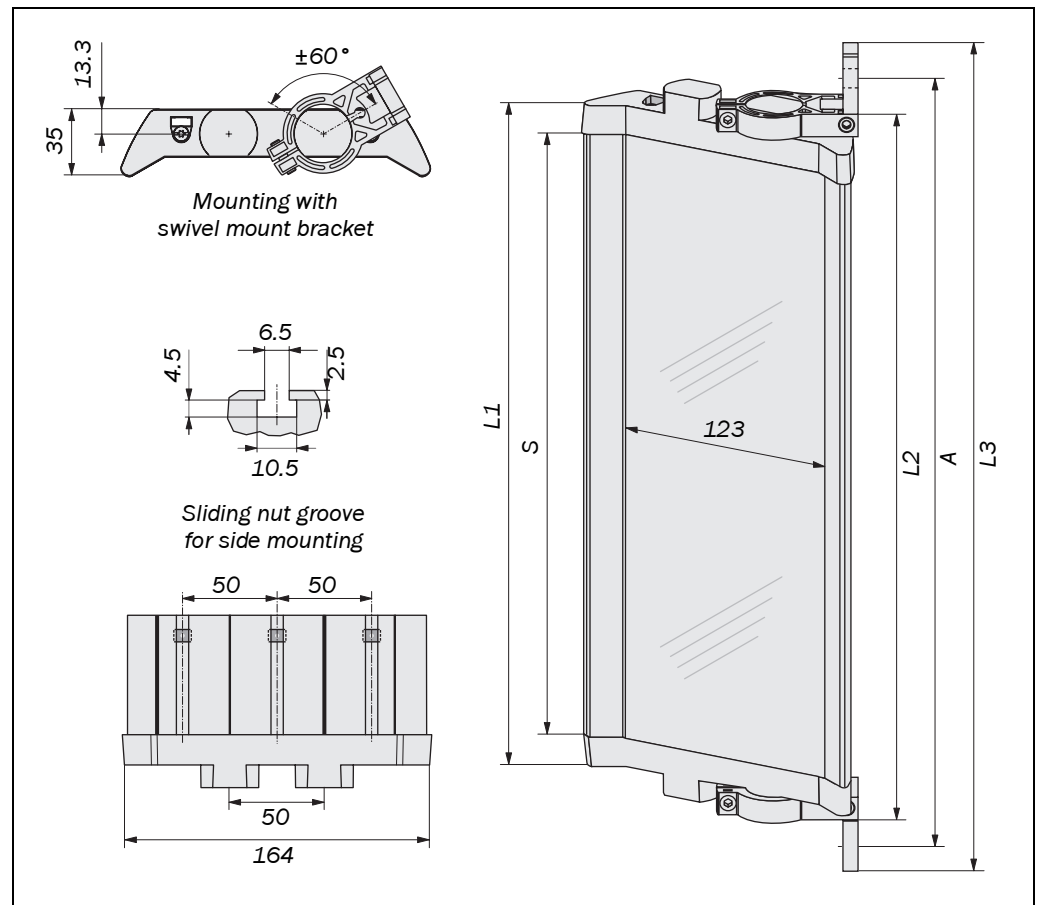
Tab. 24: Dimensions for the deflector mirror PNS 75 dependent on the mirror height

Mirror height S [mm]	Dimension L1 [mm]	Dimension L2 [mm]	Dimension L3 [mm]	Dimension A [mm]
340	372	396	460	440
490	522	546	610	590
640	672	696	760	740
790	822	846	910	890
940	972	996	1060	1040
1090	1122	1146	1210	1190
1240	1272	1296	1360	1340
1390	1422	1446	1510	1490
1540	1572	1596	1660	1640
1690	1722	1746	1810	1790
1840	1872	1896	1960	1940

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10.4.7 Deflector mirror PNS 125

Fig. 35: Dimensional drawing deflector mirror PNS 125 (mm)



Tab. 25: Dimensions for the deflector mirror PNS 125 dependent on the mirror height

Mirror height S [mm]	Dimension L1 [mm]	Dimension L2 [mm]	Dimension L3 [mm]	Dimension A [mm]
340	372	396	460	440
490	522	546	610	590
640	672	696	760	740
790	822	846	910	890
940	972	996	1060	1040
1090	1122	1146	1210	1190
1240	1272	1296	1360	1340
1390	1422	1446	1510	1490
1540	1572	1596	1660	1640
1690	1722	1746	1810	1790
1840	1872	1896	1960	1940

11 Ordering information

11.1 Delivery

Delivery, sender

- Sender unit
- 4 sliding nuts for side bracket

Delivery, receiver

- Receiver unit
- 4 sliding nuts for side bracket
- Test rod with diameter corresponding to the physical resolution of the safety light curtain
- Information label "Important Information"
- Operating instructions on CD-ROM
- CDS (Configuration & Diagnostic Software) on CD-ROM
- Connecting cable to serial interface
- Information label "Operator's notes"

Function package B

Function package B is available as an option and includes:

- Function Blanking (cf. page 16 ff.)
- Function Reduced Resolution (cf. page 19)
- Additional test rods for testing the effective resolution:
 - for 14 mm systems: diameters 22, 30 and 37 mm
 - for 20 mm systems: diameters 30 and 40 mm
- Information labels for the resolution of the device

Pre-configured systems

Standard systems without function package B are optionally available with the pre-configurations C, D, E and F (see section 7.1 "Delivery status" on page 39).

Delivery, deflector mirror

- Deflector mirror
- 4 sliding nuts for side bracket

11.2 Standard system

For use as single system or as last guest of a cascable system.

11.2.1 Standard system without function package

Tab. 26: Part numbers, standard system without function package

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	▣ 1 018 591	▣ 1 018 613	▣ 1 018 635	▣ 1 018 657
	▣ 1 018 592	▣ 1 018 614	▣ 1 018 636	▣ 1 018 658
450	▣ 1 018 347	▣ 1 018 615	▣ 1 018 637	▣ 1 018 659
	▣ 1 018 348	▣ 1 018 616	▣ 1 018 638	▣ 1 018 660
600	▣ 1 018 593	▣ 1 018 617	▣ 1 018 639	▣ 1 018 661
	▣ 1 018 594	▣ 1 018 618	▣ 1 018 640	▣ 1 018 662
750	▣ 1 018 595	▣ 1 018 619	▣ 1 018 641	▣ 1 018 663
	▣ 1 018 596	▣ 1 018 620	▣ 1 018 642	▣ 1 018 664
900	▣ 1 018 597	▣ 1 018 621	▣ 1 018 643	▣ 1 018 665
	▣ 1 018 598	▣ 1 018 622	▣ 1 018 644	▣ 1 018 666
1050	▣ 1 018 599	▣ 1 018 623	▣ 1 018 645	▣ 1 018 667
	▣ 1 018 600	▣ 1 018 624	▣ 1 018 646	▣ 1 018 668
1200	▣ 1 018 601	▣ 1 018 625	▣ 1 018 647	▣ 1 018 669
	▣ 1 018 602	▣ 1 018 626	▣ 1 018 648	▣ 1 018 670
1350	▣ 1 018 603	▣ 1 018 627	▣ 1 018 649	▣ 1 018 671
	▣ 1 018 604	▣ 1 018 628	▣ 1 018 650	▣ 1 018 672
1500	▣ 1 018 605	▣ 1 018 629	▣ 1 018 651	▣ 1 018 673
	▣ 1 018 606	▣ 1 018 630	▣ 1 018 652	▣ 1 018 674
1650	▣ 1 018 607	▣ 1 018 631	▣ 1 018 653	▣ 1 018 675
	▣ 1 018 608	▣ 1 018 632	▣ 1 018 654	▣ 1 018 676
1800	▣ 1 018 609	▣ 1 018 633	▣ 1 018 655	▣ 1 018 677
	▣ 1 018 610	▣ 1 018 634	▣ 1 018 656	▣ 1 018 678

11.2.2 Standard system without function package, with angled system connection

Tab. 27: Part numbers, standard system without function package, with angled system connection

Protective field height [mm]	Part numbers for resolution	
	14 mm	
300	▣ 1 022 267	
	▣ 1 022 268	

Other systems on request.

11.2.3 Standard system with function package B

Tab. 28: Part numbers, standard system with function package B

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 591	➡ 1 018 613	➡ 1 018 635	➡ 1 018 657
	➡ 1 018 781	➡ 1 018 792	➡ 1 018 803	➡ 1 018 815
450	➡ 1 018 347	➡ 1 018 615	➡ 1 018 637	➡ 1 018 659
	➡ 1 018 782	➡ 1 018 793	➡ 1 018 804	➡ 1 018 816
600	➡ 1 018 593	➡ 1 018 617	➡ 1 018 639	➡ 1 018 661
	➡ 1 018 783	➡ 1 018 794	➡ 1 018 805	➡ 1 018 817
750	➡ 1 018 595	➡ 1 018 619	➡ 1 018 641	➡ 1 018 663
	➡ 1 018 784	➡ 1 018 795	➡ 1 018 806	➡ 1 018 818
900	➡ 1 018 597	➡ 1 018 621	➡ 1 018 643	➡ 1 018 665
	➡ 1 018 785	➡ 1 018 796	➡ 1 018 807	➡ 1 018 819
1050	➡ 1 018 599	➡ 1 018 623	➡ 1 018 645	➡ 1 018 667
	➡ 1 018 786	➡ 1 018 797	➡ 1 018 809	➡ 1 018 820
1200	➡ 1 018 601	➡ 1 018 625	➡ 1 018 647	➡ 1 018 669
	➡ 1 018 787	➡ 1 018 798	➡ 1 018 810	➡ 1 018 821
1350	➡ 1 018 603	➡ 1 018 627	➡ 1 018 649	➡ 1 018 671
	➡ 1 018 788	➡ 1 018 799	➡ 1 018 811	➡ 1 018 822
1500	➡ 1 018 605	➡ 1 018 629	➡ 1 018 651	➡ 1 018 673
	➡ 1 018 789	➡ 1 018 800	➡ 1 018 812	➡ 1 018 823
1650	➡ 1 018 607	➡ 1 018 631	➡ 1 018 653	➡ 1 018 675
	➡ 1 018 790	➡ 1 018 801	➡ 1 018 813	➡ 1 018 824
1800	➡ 1 018 609	➡ 1 018 633	➡ 1 018 655	➡ 1 018 677
	➡ 1 018 791	➡ 1 018 802	➡ 1 018 814	➡ 1 018 825

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11.2.4 Standard system without function package, with pre-configuration C

The pre-configuration is a specific system delivery state (see section 7.1 “Delivery status” on page 39). You can change this configuration using the software supplied.

Tab. 29: Part numbers, standard system without function package, with pre-configuration C

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 591	➡ 1 018 613	➡ 1 018 635	➡ 1 018 657
	➡ 1 022 358	➡ 1 022 369	➡ 1 022 380	➡ 1 022 391
450	➡ 1 018 347	➡ 1 018 615	➡ 1 018 637	➡ 1 018 659
	➡ 1 022 359	➡ 1 022 370	➡ 1 022 381	➡ 1 022 392
600	➡ 1 018 593	➡ 1 018 617	➡ 1 018 639	➡ 1 018 661
	➡ 1 022 360	➡ 1 022 371	➡ 1 022 382	➡ 1 022 393
750	➡ 1 018 595	➡ 1 018 619	➡ 1 018 641	➡ 1 018 663
	➡ 1 022 361	➡ 1 022 372	➡ 1 022 383	➡ 1 022 394
900	➡ 1 018 597	➡ 1 018 621	➡ 1 018 643	➡ 1 018 665
	➡ 1 022 362	➡ 1 022 373	➡ 1 022 384	➡ 1 022 395
1050	➡ 1 018 599	➡ 1 018 623	➡ 1 018 645	➡ 1 018 667
	➡ 1 022 363	➡ 1 022 374	➡ 1 022 385	➡ 1 022 396
1200	➡ 1 018 601	➡ 1 018 625	➡ 1 018 647	➡ 1 018 669
	➡ 1 022 364	➡ 1 022 375	➡ 1 022 386	➡ 1 022 397
1350	➡ 1 018 603	➡ 1 018 627	➡ 1 018 649	➡ 1 018 671
	➡ 1 022 365	➡ 1 022 376	➡ 1 022 387	➡ 1 022 398
1500	➡ 1 018 605	➡ 1 018 629	➡ 1 018 651	➡ 1 018 673
	➡ 1 022 366	➡ 1 022 377	➡ 1 022 388	➡ 1 022 399
1650	➡ 1 018 607	➡ 1 018 631	➡ 1 018 653	➡ 1 018 675
	➡ 1 022 367	➡ 1 022 378	➡ 1 022 389	➡ 1 022 400
1800	➡ 1 018 609	➡ 1 018 633	➡ 1 018 655	➡ 1 018 677
	➡ 1 022 368	➡ 1 022 379	➡ 1 022 390	➡ 1 022 401

11.2.5 Standard system without function package, with pre-configuration D

The pre-configuration is a specific system delivery state (see section 7.1 “Delivery status” on page 39). You can change this configuration using the software supplied.

Tab. 30: Part numbers, standard system without function package, with pre-configuration D

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 591	➡ 1 018 613	➡ 1 018 635	➡ 1 018 657
	➡ 1 022 402	➡ 1 022 413	➡ 1 022 424	➡ 1 022 435
450	➡ 1 018 347	➡ 1 018 615	➡ 1 018 637	➡ 1 018 659
	➡ 1 022 403	➡ 1 022 414	➡ 1 022 425	➡ 1 022 436
600	➡ 1 018 593	➡ 1 018 617	➡ 1 018 639	➡ 1 018 661
	➡ 1 022 404	➡ 1 022 415	➡ 1 022 426	➡ 1 022 437
750	➡ 1 018 595	➡ 1 018 619	➡ 1 018 641	➡ 1 018 663
	➡ 1 022 405	➡ 1 022 416	➡ 1 022 427	➡ 1 022 438
900	➡ 1 018 597	➡ 1 018 621	➡ 1 018 643	➡ 1 018 665
	➡ 1 022 406	➡ 1 022 417	➡ 1 022 428	➡ 1 022 439
1050	➡ 1 018 599	➡ 1 018 623	➡ 1 018 645	➡ 1 018 667
	➡ 1 022 407	➡ 1 022 418	➡ 1 022 429	➡ 1 022 440
1200	➡ 1 018 601	➡ 1 018 625	➡ 1 018 647	➡ 1 018 669
	➡ 1 022 408	➡ 1 022 419	➡ 1 022 430	➡ 1 022 441
1350	➡ 1 018 603	➡ 1 018 627	➡ 1 018 649	➡ 1 018 671
	➡ 1 022 409	➡ 1 022 420	➡ 1 022 431	➡ 1 022 442
1500	➡ 1 018 605	➡ 1 018 629	➡ 1 018 651	➡ 1 018 673
	➡ 1 022 410	➡ 1 022 421	➡ 1 022 432	➡ 1 022 443
1650	➡ 1 018 607	➡ 1 018 631	➡ 1 018 653	➡ 1 018 675
	➡ 1 022 411	➡ 1 022 422	➡ 1 022 433	➡ 1 022 444
1800	➡ 1 018 609	➡ 1 018 633	➡ 1 018 655	➡ 1 018 677
	➡ 1 022 412	➡ 1 022 423	➡ 1 022 434	➡ 1 022 445

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11.2.6 Standard system without function package, with pre-configuration E

The pre-configuration is a specific system delivery state (see section 7.1 “Delivery status” on page 39). You can change this configuration using the software supplied.

Tab. 31: Part numbers, standard system without function package, with pre-configuration E

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 591	➡ 1 018 613	➡ 1 018 635	➡ 1 018 657
	➡ 1 022 446	➡ 1 022 457	➡ 1 022 468	➡ 1 022 479
450	➡ 1 018 347	➡ 1 018 615	➡ 1 018 637	➡ 1 018 659
	➡ 1 022 447	➡ 1 022 458	➡ 1 022 469	➡ 1 022 480
600	➡ 1 018 593	➡ 1 018 617	➡ 1 018 639	➡ 1 018 661
	➡ 1 022 448	➡ 1 022 459	➡ 1 022 470	➡ 1 022 481
750	➡ 1 018 595	➡ 1 018 619	➡ 1 018 641	➡ 1 018 663
	➡ 1 022 449	➡ 1 022 460	➡ 1 022 471	➡ 1 022 482
900	➡ 1 018 597	➡ 1 018 621	➡ 1 018 643	➡ 1 018 665
	➡ 1 022 450	➡ 1 022 461	➡ 1 022 472	➡ 1 022 483
1050	➡ 1 018 599	➡ 1 018 623	➡ 1 018 645	➡ 1 018 667
	➡ 1 022 451	➡ 1 022 462	➡ 1 022 473	➡ 1 022 484
1200	➡ 1 018 601	➡ 1 018 625	➡ 1 018 647	➡ 1 018 669
	➡ 1 022 452	➡ 1 022 463	➡ 1 022 474	➡ 1 022 485
1350	➡ 1 018 603	➡ 1 018 627	➡ 1 018 649	➡ 1 018 671
	➡ 1 022 453	➡ 1 022 464	➡ 1 022 475	➡ 1 022 486
1500	➡ 1 018 605	➡ 1 018 629	➡ 1 018 651	➡ 1 018 673
	➡ 1 022 454	➡ 1 022 465	➡ 1 022 476	➡ 1 022 487
1650	➡ 1 018 607	➡ 1 018 631	➡ 1 018 653	➡ 1 018 675
	➡ 1 022 455	➡ 1 022 466	➡ 1 022 477	➡ 1 022 488
1800	➡ 1 018 609	➡ 1 018 633	➡ 1 018 655	➡ 1 018 677
	➡ 1 022 456	➡ 1 022 467	➡ 1 022 478	➡ 1 022 489

11.2.7 Standard system without function package, with pre-configuration F

The pre-configuration is a specific system delivery state (see section 7.1 “Delivery status” on page 39). You can change this configuration using the software supplied.

Tab. 32: Part numbers, standard system without function package, with pre-configuration F

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 591	➡ 1 018 613	➡ 1 018 635	➡ 1 018 657
	➡ 1 022 490	➡ 1 022 501	➡ 1 022 512	➡ 1 022 523
450	➡ 1 018 347	➡ 1 018 615	➡ 1 018 637	➡ 1 018 659
	➡ 1 022 491	➡ 1 022 502	➡ 1 022 513	➡ 1 022 524
600	➡ 1 018 593	➡ 1 018 617	➡ 1 018 639	➡ 1 018 661
	➡ 1 022 492	➡ 1 022 503	➡ 1 022 514	➡ 1 022 525
750	➡ 1 018 595	➡ 1 018 619	➡ 1 018 641	➡ 1 018 663
	➡ 1 022 493	➡ 1 022 504	➡ 1 022 515	➡ 1 022 526
900	➡ 1 018 597	➡ 1 018 621	➡ 1 018 643	➡ 1 018 665
	➡ 1 022 494	➡ 1 022 505	➡ 1 022 516	➡ 1 022 527
1050	➡ 1 018 599	➡ 1 018 623	➡ 1 018 645	➡ 1 018 667
	➡ 1 022 495	➡ 1 022 506	➡ 1 022 517	➡ 1 022 528
1200	➡ 1 018 601	➡ 1 018 625	➡ 1 018 647	➡ 1 018 669
	➡ 1 022 496	➡ 1 022 507	➡ 1 022 518	➡ 1 022 529
1350	➡ 1 018 603	➡ 1 018 627	➡ 1 018 649	➡ 1 018 671
	➡ 1 022 497	➡ 1 022 508	➡ 1 022 519	➡ 1 022 530
1500	➡ 1 018 605	➡ 1 018 629	➡ 1 018 651	➡ 1 018 673
	➡ 1 022 498	➡ 1 022 509	➡ 1 022 520	➡ 1 022 531
1650	➡ 1 018 607	➡ 1 018 631	➡ 1 018 653	➡ 1 018 675
	➡ 1 022 499	➡ 1 022 510	➡ 1 022 521	➡ 1 022 532
1800	➡ 1 018 609	➡ 1 018 633	➡ 1 018 655	➡ 1 018 677
	➡ 1 022 500	➡ 1 022 511	➡ 1 022 522	➡ 1 022 533

11.3 Cascadable system

For use as single system, as host or as first or second guest of a host/guest system.

11.3.1 Cascadable system without function package

Tab. 33: Part numbers, cascadable system without function package

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 690	➡ 1 018 710	➡ 1 018 733	➡ 1 018 755
	➡ 1 018 691	➡ 1 018 711	➡ 1 018 734	➡ 1 018 756
450	➡ 1 018 349	➡ 1 018 712	➡ 1 018 735	➡ 1 018 757
	➡ 1 018 350	➡ 1 018 713	➡ 1 018 736	➡ 1 018 758
600	➡ 1 018 692	➡ 1 018 714	➡ 1 018 737	➡ 1 018 759
	➡ 1 018 693	➡ 1 018 715	➡ 1 018 738	➡ 1 018 760
750	➡ 1 018 694	➡ 1 018 716	➡ 1 018 739	➡ 1 018 762
	➡ 1 018 695	➡ 1 018 717	➡ 1 018 740	➡ 1 018 763
900	➡ 1 018 696	➡ 1 018 718	➡ 1 018 741	➡ 1 018 765
	➡ 1 018 697	➡ 1 018 719	➡ 1 018 742	➡ 1 018 766
1050	➡ 1 018 698	➡ 1 018 720	➡ 1 018 743	➡ 1 018 767
	➡ 1 018 699	➡ 1 018 721	➡ 1 018 744	➡ 1 018 768
1200	➡ 1 018 700	➡ 1 018 722	➡ 1 018 745	➡ 1 018 769
	➡ 1 018 701	➡ 1 018 723	➡ 1 018 746	➡ 1 018 770
1350	➡ 1 018 702	➡ 1 018 724	➡ 1 018 747	➡ 1 018 771
	➡ 1 018 703	➡ 1 018 725	➡ 1 018 748	➡ 1 018 772
1500	➡ 1 018 704	➡ 1 018 726	➡ 1 018 749	➡ 1 018 773
	➡ 1 018 705	➡ 1 018 727	➡ 1 018 750	➡ 1 018 774
1650	➡ 1 018 706	➡ 1 018 728	➡ 1 018 751	➡ 1 018 775
	➡ 1 018 707	➡ 1 018 729	➡ 1 018 752	➡ 1 018 776
1800	➡ 1 018 708	➡ 1 018 730	➡ 1 018 753	➡ 1 018 777
	➡ 1 018 709	➡ 1 018 731	➡ 1 018 754	➡ 1 018 778

11.3.2 Cascadable system with function package B

Tab. 34: Part numbers, cascadable system with function package B

Protective field height [mm]	Part numbers for resolution			
	14 mm	20 mm	30 mm	40 mm
300	➡ 1 018 690	➡ 1 018 710	➡ 1 018 733	➡ 1 018 755
	➡ 1 018 827	➡ 1 018 838	➡ 1 018 849	➡ 1 018 860
450	➡ 1 018 349	➡ 1 018 712	➡ 1 018 735	➡ 1 018 757
	➡ 1 018 828	➡ 1 018 839	➡ 1 018 850	➡ 1 018 861
600	➡ 1 018 692	➡ 1 018 714	➡ 1 018 737	➡ 1 018 759
	➡ 1 018 829	➡ 1 018 840	➡ 1 018 851	➡ 1 018 862
750	➡ 1 018 694	➡ 1 018 716	➡ 1 018 739	➡ 1 018 762
	➡ 1 018 830	➡ 1 018 841	➡ 1 018 852	➡ 1 018 863
900	➡ 1 018 696	➡ 1 018 718	➡ 1 018 741	➡ 1 018 765
	➡ 1 018 831	➡ 1 018 842	➡ 1 018 853	➡ 1 018 864
1050	➡ 1 018 698	➡ 1 018 720	➡ 1 018 743	➡ 1 018 767
	➡ 1 018 832	➡ 1 018 843	➡ 1 018 854	➡ 1 018 865
1200	➡ 1 018 700	➡ 1 018 722	➡ 1 018 745	➡ 1 018 769
	➡ 1 018 833	➡ 1 018 844	➡ 1 018 855	➡ 1 018 866
1350	➡ 1 018 702	➡ 1 018 724	➡ 1 018 747	➡ 1 018 771
	➡ 1 018 834	➡ 1 018 845	➡ 1 018 856	➡ 1 018 867
1500	➡ 1 018 704	➡ 1 018 726	➡ 1 018 749	➡ 1 018 773
	➡ 1 018 835	➡ 1 018 846	➡ 1 018 857	➡ 1 018 868
1650	➡ 1 018 706	➡ 1 018 728	➡ 1 018 751	➡ 1 018 775
	➡ 1 018 836	➡ 1 018 847	➡ 1 018 858	➡ 1 018 869
1800	➡ 1 018 708	➡ 1 018 730	➡ 1 018 753	➡ 1 018 777
	➡ 1 018 837	➡ 1 018 848	➡ 1 018 859	➡ 1 018 870

11.4 Additional front screen (weld spark guard)

- Notes**
- Two additional front screens (weld spark guards) supplied for each part number.
 - The additional front screen fits both on the sender and on the receiver.
 - The additional front screen may be used only if the curved enclosure side is accessible.
 - An additional front screen reduces the scanning range of the system by 8%. If sender and receiver each use an additional front screen, the scanning range will be reduced by 16%.

Tab. 35: Part numbers, additional front screen (weld spark guard)

Protective field height [mm]	Part number	Protective field height [mm]	Part number
300	2 022 412	1200	2 022 418
450	2 022 413	1350	2 022 419
600	2 022 414	1500	2 022 420
750	2 022 415	1650	2 022 421
900	2 022 416	1800	2 022 422
1050	2 022 417		

11.5 Deflector mirror

11.5.1 Deflector mirror PNS 75 for protective field width 0 ... 4 m (total)

Tab. 36: Part numbers,
deflector mirror PNS 75

Protective field height [mm]	Type number	Part number
300	PNS 75-034	1 019 414
450	PNS 75-049	1 011 115
600	PNS 75-064	1 019 416
750	PNS 75-079	1 019 417
900	PNS 75-094	1 019 418
1050	PNS 75-109	1 019 419
1200	PNS 75-124	1 019 420
1350	PNS 75-139	1 019 421
1500	PNS 75-154	1 019 422
1650	PNS 75-169	1 019 423
1800	PNS 75-184	1 019 424

Dimensional drawings, see Fig. 34 on page 54.

11.5.2 Deflector mirror PNS 125 for protective field width 4 ... 15 m (total)

Tab. 37: Part numbers,
deflector mirror PNS 125

Protective field height [mm]	Type number	Part number
300	PNS 125-034	1 019 425
450	PNS 125-049	1 019 426
600	PNS 125-064	1 019 427
750	PNS 125-079	1 019 428
900	PNS 125-094	1 019 429
1050	PNS 125-109	1 019 430
1200	PNS 125-124	1 019 431
1350	PNS 125-139	1 019 432
1500	PNS 125-154	1 019 433
1650	PNS 125-169	1 019 434
1800	PNS 125-184	1 019 435

Dimensional drawings, see Fig. 35 on page 55.

Tab. 38: Part numbers, accessories

11.6 Accessories

Part	Part number
C 4000 Standard	
Hirschmann cable socket M 26×11 + FE, crimp contacts, straight	6 020 757
Hirschmann cable socket M 26×11 + FE, crimp contacts, angled	6 020 758
Connection cable for standard type and cascable devices	
Plug straight/stripped, 2.5 m	2 022 544
Plug straight/stripped, 5 m	2 022 545
Plug straight/stripped, 7.5 m	2 022 546
Plug straight/stripped, 10 m	2 022 547
Plug straight/stripped, 15 m	2 022 548
Plug straight/stripped, 20 m	2 022 549
Plug straight/stripped, 30 m	2 022 550
C 4000 cascable	
Connection cable between cascable devices, see "C 4000 Standard"	
Connection cable between cascable devices	
Plug straight/socket straight, 0,25 m	2 022 278
Plug straight/socket angled, 0,25 m	2 022 284
Plug straight/socket straight, 0.5 m	2 021 838
Plug straight/socket angled, 0.5 m	2 022 285
Plug straight/socket straight, 1 m	2 022 279
Plug straight/socket angled, 1 m	2 022 286
Plug straight/socket straight, 1.5 m	2 022 280
Plug straight/socket angled, 1.5 m	2 022 287
Plug straight/socket straight, 2 m	2 022 281
Plug straight/socket angled, 2 m	2 022 288
Plug straight/socket straight, 2.5 m	2 022 282
Plug straight/socket angled, 2.5 m	2 022 289
Plug straight/socket straight, 3 m	2 022 283
Plug straight/socket angled, 3 m	2 022 290
Mounting kit 2	
Swivel mount, 4 pcs. for any protective field height	2 019 659
Mounting kit 6	
Swivel function (side bracket), 4 pcs. for any protective field height For higher vibration and shock exposure	2 019 506
Accessories included in a standard delivery	
Sliding nuts for side bracket, 4 pcs.	2 017 550
CDS (Configuration & Diagnostic Software) on CD-ROM incl. online documentation	2 022 385
Connection cable between the serial interface of the PC and the configuration interface	6 021 195

12 Annex

12.1 Declaration of conformity

SICK

EC Declaration of Conformity

Under the terms of EC Machine Directive 98/37/EEC, Appendix VI

We hereby declare that the devices
of the product family C4000

are safety components for a machine constructed as per the EC directive 98/37/EEC art. 1 para. 2. This declaration will lose its validity if any modification to a device used in the plant is made without prior consultation.

We employ a quality system certified by the DQS (German Quality Assurance Society), No. 462, as per ISO 9001 and have therefore observed the regulations in accordance with module H as well as the following EC directives and EN standards during development and production:

1. EC directives	EC machine directive 98/37/EEC		
	EC EMC directive 89/336/EEC as per 92/31/EEC, 93/68/EEC, 93/465/EEC		
2. Harmonized standards and preliminary standards used	DIN EN 954-1	Safety-related components of controllers	Ed. 97-03
	DIN EN 60204-1	Electr. equip. of mach.	Ed. 98-11
	DIN EN 61496-1	Safety of mach., active opto-electronic protective devices (AOPD)	Ed. 98-06
	IEC 61496-2	Safety of mach., active opto-electronic protective devices (AOPD)	Ed. 97-05
	DIN V VDE 0801/A1	Basic principles for computers in systems with safety functions	Ed. 94-10
3. Test result	EN 61496	BWS type 4	


Conformance of a type sample belonging to the above-mentioned product family with the regulations from the EC machine directive has been certified by:


Address of notified authority (Germany)
TÜV Rheinland
Am Grauen Stein
D-51105 Köln

EC type sample test No BB2011540 01 dated 2000-11-13

The CE mark was affixed to the appliance in conformance with directive 89/336/EEC.

Waldkirch/Br., 2000-11-24


ppa. Dr. Plasberg
(Head of Development
Division Safety Systems)


ppa. Zinöber
(Head of Production
Division Safety Systems)

The declaration certifies conformance with the listed directives, but does not guarantee product characteristics. The safety instructions contained in the product documentation must be observed.

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12.2 Checklist for the manufacturer

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Checklist for the manufacturer/OEM for the installation of electro-sensitive protective equipment (ESPE)

The details on the items listed below must be available at the latest when the system is commissioned for the first time, depending, however, on the various applications the requirements of which must be reviewed by the manufacturer/OEM.

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

- | | | |
|---|------------------------------|-----------------------------|
| 1. Have the safety rules and regulations been observed in compliance with the directives/standards applicable to the machine? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 2. Are the applied directives and standards listed in the declaration of conformity? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 3. Does the protective device comply with the required control category? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 4. Is the access to the hazardous area/the hazardous point allowed only through the protective field of the ESPE? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 5. Have appropriate measures been taken to prevent or monitor presence sensing in the hazardous area in the hazardous area/hazardous point protection (mechanical point-of-operation guarding) and have these been secured against removal? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 6. Are additional mechanical protective devices fitted and secured against manipulation which prevent reaching over, under or around the ESPE? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 7. Has the maximum stopping and/or post-run time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 8. Has the ESPE been mounted such that the required safety distance from the nearest point of danger has been achieved? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 9. Are the ESPE devices properly mounted and secured against manipulation after adjustment? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 10. Are the required protective measures against electric shock in effect (protection class)? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 11. Has the control switch for resetting the ESPE protective device and/or for restarting the machine been fitted and properly mounted and connected? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 12. Are the outputs of the ESPE (OSSD) integrated in compliance with the required control category and does the integration comply with the circuit diagrams? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 13. Has the protective function been checked in compliance with the test notes of this documentation? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 14. Are the required protective functions effective in every setting of the operating mode selector switch? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 15. Are the switching elements monitored, e.g. EDMs, valves which are activated by the ESPE? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 16. Is the ESPE effective over the entire period of the dangerous state? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 17. Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 18. Has the Information label "Important Information" for the daily check been attached so that it is well visible for the operator? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

This checklist does not replace the initial commissioning, nor the regular inspection by specialist personnel.

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